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ABSTRACT

A major effort of the National Center for Higher Education Management Systems over the past few years has been the development of information Exchange Procedures (IEP) for a broad spectrum of colleges and universities. The motivation for this effort is the strong belief that the exchange and comparative analysis of data will lead to better information for addressing planning and management functions. This document is designed primarily for an audience of those who are well acquainted with IEP data and procedures, and who have implemented all or part of IEP. The examples and analytic procedures described here, however, do not depend on the exchange of information or on the comparative analysis of data across institutions, but rather are designed to illuminate institutional processes and to address planning and management concerns through use of the institution's own IEP data. Three types of data use are described and illustrated: (1) general descriptive narrative of the institution; (2) more detailed and quantitative descriptive profiles of the institution's departments and student major programs; (3) data use directed toward explanation in addition to description, i.e., differences in costs and in student outcome measures across the departments and student major programs. (JMF)

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# IEP ANALYSIS AND USE:

# SINGLE-INSTITUTION DATA

Field Review Edition

Technical Report No. 73

Maureen Byers

Cathleen Bower

June 1975

National Center for Higher Education Management Systems
at Western Interstate Commission for Higher Education
P.O. Drawer P Boulder, Colorado 80302

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HE 006 860

To the Postsecondary Education Community:

This field review edition of IEP Analysis and Use: Single-Institution Data is being sent to all postsecondary institutions and agencies participating in the programs of the National Center for Higher Education Management Systems (NCHEMS) to solicit comments regarding its content and potential uses.

The document is intended as an aid to institutional planners, managers, and analysts in the understanding and use of data collected through NCHEMS Information Exchange Procedures (IEP). Its usefulness as such an aid will be assessed in a pilot test of the manual in late 1975 and early 1976. It is important, however, that the NCHEMS staff also obtain critical response from all interested managers and administrators.

The manual is designed primarily for those who are familiar with IEP data and procedures. We request that you circulate this edition to such individuals within your institution and to others who are in a position to review it critically and constructively. We request also that you and others who review the document give particular attention to actual planning and management problems facing your institution and ways in which the data uses outlined here may help to address them.

Written comments addressed to such applications and to other aspects of the manual may be in the form of letters or notations in the document returned to the authors at the National Center for Higher Education Management Systems, P.O. Drawer P, Boulder, Colorado 80302. Please send your comments by November 1, 1975.

Bob Wallhaus

Robert A. Wallhaus
Deputy Director
National Center for Higher
Education Management Systems
at WICHE

# PREFACE

This field review document is intended as an aid to institutional planners, managers, and analysts in the understanding and use of data collected through the NCHEMS Information Exchange Procedures (IEP). It is designed primarily for an IEP audience--that is, an audience of those who are well acquainted with IEP data and procedures, and who have implemented all or part of IEP or anticipate doing so. The examples and analytical procedures described here, however, do not depend on the exchange of information or on the comparative analysis of IEP data across institutions. Rather, they are designed to illuminate institutional processes and to address planning and management concerns through use of the institution's own IEP data.

Three types of data use are described and illustrated. The first is a general descriptive narrative of the institution, aimed largely at acquainting the non-technical user or audience with the scope and potential of IEP data. The second consists of more detailed and more quantitative descriptive profiles of the institution's departments and student major programs. These are intended to assist the user to understand what is happening in the important instructional units of the institution. The third and most extensive type of data use is directed toward explanation in addition to description. The particular concerns addressed in this third category of IEP data use are differences in costs and in student outcomes measures across the departments and student major programs of the institution.

The procedures and guidelines presented in this document will be pilot tested during late 1975 and early 1976 in institutions participating in IEP. Special attention will be given to documenting the actual use of IEP data in decision-making situations within the institution and supplementing the manual with illustrations of such use. The results of the pilot test and field review will be incorporated as appropriate in a revised version of the manual to be published in mid-1976.

## ACKNOWLEDGMENTS

This document is the first published product of the Institutional Data Uses project at NCHEMS and represents the ideas and efforts of many members of the NCHEMS staff. Thanks to all of those who influenced its development through their careful review of earlier versions.

We would like to single out a few of our colleagues for special thanks: Al Service, project manager, for his leadership and ideas; Jim Topping, for his advice on the cost studies and his overall support; Anahid Katchian, for her valuable suggestions on the document's content and organization throughout its development; Jerry Johnson, for computer analysis support; Jean Strueber, for editorial and production assistance; and Marlene Crist, Marc Owens, and Linda Smith, who managed to cope with the idiosyncracies and inconsistencies inherent in a document with two authors.

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Thanks to you all.

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# I

# INTRODUCTION

A major effort of the National Center for Higher Education Management Systems over the past three to five years has been the development of Information Exchange Procedures (IEP) for a broad spectrum of colleges and universities. The primary motivation for this effort is the strong belief that the exchange and comparative analysis of data will lead to better information for addressing planning and management functions in postsecondary education institutions and, in the end, will result in better decisions.

IEP is directed toward data exchange and comparative analysis over a diverse population of institutions, and thus it has been mandatory that careful attention be given to information compatibility. That is, an element of information that is to be exchanged among institutions--or even aggregated across departments in a single institution--should carry the same definition in each place and should be collected or derived by way of the same procedures. These were major criteria in the development of the basic IEP data set.

The implementation of procedures for institutional collection of IEP data has been through two stages of field testing: the 1973 consortium implementation project and the 1974 pilot test. A third effort is now underway: the wide-scale implementation of Information Exchange Procedures. The data set included in this implementation contains information in six categories:

- General information about the institution
- Information about students (demographics, enrollment status, financial aid)
- Information about resources (personnel, facilities)
- Institutional financial information (revenues by source, balance sheet)
- Information on unit costs (for disciplines and student programs)
- Student outcomes information (occupational and educational plans, perceptions of growth).

The collection and aggregation of this information is assisted by the computer software of the NCHEMS Costing and Data Management System, an overview of which is found in the appendix.

Accompanying the wide-scale implementation are efforts to develop and refine the actual mechanism by which information is exchanged among institutions, and to describe ways in which multi-institution information may be applied to the solution of planning and management problems. The present document is somewhat different for it is addressed to the following question: How may an institution make use of its own IEP data set, even if it never exchanges information with another institution?

Use of Single-Institution IEP Data

The 1973 and 1974 IEP field experiences had beneficial side effects. In addition to demonstrating the feasibility of collection of IEP data across diverse institutions, those experiences caused some institutions to see themselves in a new light and to ask questions that they now could begin to answer on the basis of

their newly acquired data. Brief narratives of IEP data uses in twelve of the 1973 consortium institutions are found in Profiles of Management Information Uses (Huff and Young, 1974). A smaller number of in-depth case studies from the 1974 pilot test also have been documented (Service and Oberbeck, forthcoming).

The information uses described in these documents are numerous and varied; they include resource allocation, curriculum development, contract negotiations, budget preparation, cost explanation, and accreditation self studies. The data have been used at the level of the department; the school, college, or division; and the overall institution. Specific users have included department heads, deans, academic senates, institutional research directors, vice-presidents (for academic affairs, student affairs, budget and finance), presidents, system officers, and boards of trustees.

From the experience of these institutions, it seemed likely that others also could be encouraged to use their IEP data to assist in planning and management. The data set by itself may provide new insights into institutional operations. In addition, it may furnish the raw material for closer examination and analysis of some institutional activities, costs, and outcomes, and of the factors behind them.

The process of implementing IEP results in two bodies of information in somewhat different forms. One of these is the data set described in Information Exchange Procedures Data Formats and Definitions (NCHEMS Technical Report No. 64). This document contains the formats recommended for collection and display of IEP data as well as a complete glossary of IEP terminology and definitions. The other

body of information consists of the computer printouts from the several software modules of the NCHEMS Costing and Data Management System. The present document makes use of both sources of information. (Samples of each are found in the appendix.) In some instances, however, neither form as it stands is optimal for institutional examination and use of the data. One may be too highly aggregate, the other too detailed and cumbersome. Therefore, attention must be given in this manual to presenting the data in a form that is well suited to the institutional user, without doing injustice to the compatibility and integrity of the basic IEP data set.

## The Purpose and Organization of this Document

It is the purpose of this document to enhance the ability of institutions to make use of their IEP data in conducting, planning and management activities. This purpose is pursued in the following steps.

1. Three ways of presenting IEP data are described and illustrated:
   a. A descriptive narrative of the institution, designed to communicate succinctly the relevant content of the IEP data base, particularly to the nontechnical user.
   b. Detailed profiles of student degree programs, disciplines, departments, and other organizational units, designed to amass in one place all the IEP data about the particular program or organizational unit being examined.
   c. Analytical studies that address issues of particular concern in a manner that goes beyond simple description. The three studies shown here deal with (1) costs and cost differences

across disciplines and student programs, (2) the examination of student outcomes and their differences across student programs and other student subpopulations, and (3) the documentation and analysis of trends over time in costs, student outcomes, and enrollment patterns.

2. For each kind of data presentation, procedures are given for obtaining the necessary information, either from the IEP data formats or from the computer printout.
3. Comments and guidelines are given for each type of data presentation. These include particular attention to data limitations and interpretation.
4. Each type of data is accompanied by a brief discussion of planning and management activities for which it may be relevant.

It should be noted that nearly all the procedures, interpretations, and data uses developed in this document deal with the institution's instructional activities and their associated costs and outcomes. In fact, this is true of IEP per se. Since it is intended for a large population of institutions, IEP emphasizes the very substantial, primary function that all colleges and universities share: the instruction of students. Therefore, this document is not well suited to the detailed examination of the research and public service functions that constitute a significant portion of many institutions' activities.

This manual has six sections in addition to this Introduction. Section II, Dimensions of Institutional Data Use, contains a discussion of some general parameters that should be considered in each type of data use. Section III is a presentation of the institutional descriptive narrative and accompanying

procedures. Section IV includes detailed data profiles for instructional disciplines or departments and for student degree programs. Procedures for conducting analytical studies related to costs, outcomes, and trends in data over time are given in Sections V, VI, and VII, respectively.

II

# DIMENSIONS OF INSTITUTIONAL DATA USE

The procedures and guidelines given in this manual represent two somewhat different but related approaches to institutional use of data. One approach begins with the existence of a particular data set and is addressed to the following question: What are the best ways of presenting the data set so that it will serve some immediate purposes for the institutional user and stimulate the user to discover additional applications? Sections III and IV are examples of this approach. They are intended very largely to be thought-provoking for the user rather than descriptive of a problem-solving "recipe."

The second approach starts with a question or set of questions of concern to the institution and asks: What may be learned about the answers to these questions on the basis of the data set at hand? Sections V, VI, and VII contain examples of this approach. By their nature, these examples are somewhat more prescriptive than the earlier ones, but they too are meant to be illustrative of uses of IEP information rather than exhaustive of all of its problem-solving applications.

Neither approach provides actual answers for the institutional decision maker or analyst. Rather, each presents procedures that may help the user to reach better decisions in the context of particular institutional environments. This means that in some cases it will be appropriate to modify the suggested procedure or data format to account for unique institutional conditions that cannot be anticipated in a general document of this type. It means also that attention should

be given to the institutional unit being examined, the type of planning and management activity to which the data are relevant, and the audience to whom the resulting information will be addressed. These concerns are taken up following a brief discussion of data collected in IEP.

IEP Data

The data used in this document are those from Information Exchange Procedures Data Formats and Definitions (Technical Report No. 64) supplemented by the computer printouts of the NCHEMS Costing and Data Management System. Most of the information that appears in the data formats is based on outputs from the software; some exceptions are headcount enrollments, student characteristics, and financial aid information, all of which are assumed to be taken directly from institutional records. Similarly, much of the information in the computer printouts is transferred to the data formats; not all of it is transferred, however, and some of it is transferred only in highly aggregated form. Two examples illustrate this latter point:

1. The Student Data Module contains two kinds of information: (a) the student credit hours generated by each discipline and the student programs to which they contribute and (b) the student credit hours used by each student program and the disciplines from which they are consumed. This information is essential to the calculation of unit costs of student programs. The unit costs information is transferred to the IEP data formats. The discipline contribution and student program consumption reports (which may be very bulky in the aggregate) are not transferred. Yet those

reports may be useful in their own right in describing the activities of departments and the curricular patterns of student programs.

2. Descriptive information (for example, sex, rank, tenure status, highest earned degree) is given in the IEP data formats for the institution's instruction and research professionals, but it appears only for the highest level of aggregation--the institution as a whole. For some purposes, the institutional analyst will want to examine these descriptors in less aggregate form, perhaps across departments or divisions. That usually can be done by referring back to the printouts of the Personnel Data Module or the Faculty Activity Module.

The procedures in this document make use of IEP data from both sources and they rely on several different types of data: student enrollments, course contribution and consumption patterns, personnel resources, instructional expenditures, and student outcomes. This is not to say that the document references every element of IEP data nor that it can be used only by institutions that have completed all data formats and all modules of the Costing and Data Management System. It is hoped that all institutions that have participated in IEP implemertation will be able to find some utility in these suggestions for IEP data use.

## Planning and Management Functions

This manual is one of NCHEMS's analytical tools--that is, one of a series of products developed to assist in educational planning and management by recommending

approaches to the use of information. These products are not intended to present standards or fixed guidelines, but to provide a capability and a point of departure. They are used in various ways in different planning and management activities and it is expected that they will be modified by users to reflect the unique needs of different institutions.

Some institutional planning and management functions to which these analytical tools are applied may be categorized as follows:

- Needs assessment: identification of groups to be served and determination of their needs for instruction, research, and other services.
- Institutional mission/role/scope: determination of the range of goals to be met and services to be provided by the institution and its program.
- Program planning: determination of the particular sets of activities to be developed and implemented to achieve institutional goals and objectives.
- Resource acquisition: determination of the financing pattern best suited to program implementation and development of strategies for obtaining the necessary resources.
- Resource allocation: determination of the optimum feasible distribution of resources among the institution's competing programs.
- Program implementation: development of an organization structure, management system, and operating policies and procedures needed to carry out the institution's programs; execution of the programs.
- Program evaluation: monitoring of program operation, determination of the extent to which program objectives have been achieved, and identification of both positive and negative unintended consequences and side effects.

Each of these functions is carried out, in some fashion, in every college and university, but it is likely that in many institutions at least one of them is performed unconsciously, or is approached obliquely, or produces results that are based on conventional wisdom, long-standing assumptions, or political expediency. This document is intended to assist institutions in applying information to those planning and management processes. In Sections III through VII reference will be made to those functions to which the type of data or particular procedure appears to be relevant. It is hoped, however, that the list above will stimulate the user to develop other applications of IEP data appropriate to the situation at hand.

## Institutional Components for Analysis

It is generally true that not all planning and management activities listed above will be carried out by all components of the institution. Needs assessment, for example, will most likely take place at the level of the whole institution and its community; it will be a less important activity for a specific instructional department. Resource allocation, on the other hand, is very important at the department level and beyond--down to individual courses. The development of a new student degree program may involve several diverse elements of the institution: the departments whose courses will be included in the new curriculum, admissions officers, academic counselors, and career counseling and placement professionals.

The institutional components selected for examination here reflect the fact that IEP emphasizes information about the instructional activities of colleges and universities. Those components are:

- The institution as a whole
- The instructional disciplines and the departments in which they reside
- The student (degree) programs.

The reader may note that additions may be made to this list with little effort. For example:

- Descriptive narratives may be written about subsets of the institution that are of special size or significance: for example, the College of Engineering and Applied Science.
- Detailed profiles may be constructed for organization units that house several departments or disciplines: for example, the Division of Humanities.
- Similarly, student program descriptions and student outcomes measures may be aggregated and examined over larger components: for example, all graduate degree programs in the School of Business, or all certificate programs in the Division of Occupational and Technical Education.

Other combinations and variations probably will occur to the user as the remainder of the document is examined and its procedures implemented.

## Users of IEP Analysis Results

For some pages now the terms "user" and "reader" have been used to refer to the audience for this document and for the information produced by way of its

procedures. In fact, several users are intended. Institutional researchers and analysts are most likely to be the principal readers of the manual and implementers of its suggested procedures. The results of the analysis, however, probably will be of interest to decision makers and administrators at many managerial levels in the institution. The list of potential users of IEP analysis results includes department and division heads; academic deans; budget officers; vice-presidents for academic affairs, planning, and student affairs; and presidents and their assistants. It may extend also to students, to faculty and their associations, and to regents and trustees.

The institutional analysts play a key role in the process by which IEP information reaches its potential users. They are in the best position to know what information is there and which parts of it are most appropriate for management concerns of different types at different levels. A department head, for example, may need a detailed profile of the department's resources and activities. The vice-president for academic affairs may use information of the same type, in detailed or summary form, from several academic departments. The president or board of trustees may want very general information summarized for the whole institution. In each instance, the planning and management function, the type of user, and the institutional component being examined combine to form a decision-making situation. The elements of that situation should be clearly recognized and carefully described in determining the most appropriate information--from IEP data or elsewhere--that can be brought to bear.

## Other NCHEMS Products

The definitions and procedures developed in IEP were designed to produce a basic set of institutional information for exchange with other colleges and universities. As this document is intended to show, IEP data may assist also in intrainstitutional planning and management.

One intrainstitutional use that may prove to be of value is the isolation of potential problem areas or provision of early warning signals that point to the need for additional analysis. Some of these analyses, relying on IEP data alone, are illustrated in Sections V-VII of this document. Others, however, may require information that goes beyond IEP--perhaps more detailed data about faculty resources and their activities, or student demand information that is needed for departmental planning. Several NCHEMS products may help in this respect: the Resource Requirements Prediction Model, the Academic Unit Planning Manual, the Outcome Measures and Procedures Manual, and the documents of the Faculty Activity Analysis project. An overview of each of these, along with full reference to their documentation, is given in the appendix.

# III

# NARRATIVE INSTITUTIONAL PROFILE

## Introduction

The process of collecting and compiling IEP data by no means guarantees that the data will be used in planning and management. Before that happens, a need, problem, or issue must be identified that can be addressed at least partially through the use of quantitative information. There also must be a willingness on the part of the user to employ data in the planning and management process. In addition, the prospective user must be aware of the content of a particular data set so that the viability of certain linkages between problems and data can be assessed. This section focuses on the last issue and presents formats and procedures for improving the prospective user's knowledge of the IEP data set.

In one sense, the question about what is included in the IEP data set may be answered very simply: it consists of the information in the IEP data formats. There are reasons to go further, perhaps the most compelling of which is the size of the IEP data set. The number of items is so large and the volume of data for an institution potentially so formidable that some further distillation is needed to communicate realistically with prospective users. A summary or introduction to IEP data might fill this need.

A second observation is that an automatic "market" for IEP data does not exist. Indeed, the number of individuals within an institution who are predisposed to the use of something like IEP data may be relatively small. Furthermore,

a high proportion of those without such a predisposition are likely to have nontechnical backgrounds. A nontechnical summary or "sampler" of IEP data may stimulate the interest of a larger number of potential users. Presenting this summary in narrative (rather than tabular or graphic) form may serve also to overcome a certain amount of resistance to the use of quantitative information.

The narrative profile is thus intended as a device for communicating the content of a particular institution's IEP data in a manageable and nontechnical fashion. It should serve as a first step in expanding the set of potential IEP data consumers--those who understand the nature and range of IEP data and are equipped to assess its utility with respect to their planning and management needs.

The following is a sample narrative institutional profile, constructed in a straightforward manner from the information in the IEP data formats. In addition to its role in acquainting institutional planners and managers (administrators, deans, department heads, and so forth) with the IEP data, the narrative profile also may be helpful in describing the institution and its activities to trustees, funding agencies, and other external constituencies.

Prototype Narrative Institutional Profile

(1) *Mountain Community College is a public, two-year institution located on a single campus in Tencential, Colorado. Mountain operates on a nine-month academic year and grants Associate of Arts degrees and Certificates in Business Management, Automotive Technology, Electronics, and a wide variety of other vocational and technical fields. The College is committed to an awareness of current and future economic and employment needs of the region and the nation and to the implementation of programs that will permit persons to seek and secure appropriate employment as well as lead happy and productive lives. Tuition at MCC is $360 per year for full-time in-state students and $900 per year for full-time students from outside Colorado.*

(2) *A total of 3,114 students attended Mountain Community College during the 1973-74 academic year, virtually all of them as full-time degree seekers. Almost two-thirds of the students were between 18 and 20 years of age and most of the remainder were between 21 and 29. Men outnumbered women by slightly over two to one. Among the students, 1,761 were attending college for the first time, 237 had transferred from another school, and 1,116 were in their second year at Mountain. The College awarded a total of $423,418 in financial aid to these students, most of it in the form of scholarships and work/study grants.*

(3) *During the past academic year, 1,415 students completed their programs at Mountain Community College. The three programs with the largest number of graduates were: Practical Nursing Certificate (167), Secretarial Associate*

of Arts (126), and Environmental Systems Certificate (106). Among students seeking jobs, 83% had secured positions by the time they graduated. Their average annual starting salaries ranged from a high of $10,548 for those with Welding Certificates to a low of $4,500 for those with Dental Assistant Certificates. The overall average annual salary among graduates with jobs was $6,912. A total of 282 students left the College without formally completing a degree or certificate program. Virtually all of these students were in good standing at the time of their departure.

(4) Mountain Community College is staffed by a faculty of 190 individuals, of whom 154 are full-time. Approximately 45% of the faculty are tenured and slightly less than 80% are men. Most full-time faculty members hold either Master's or Bachelor's degrees and the average annual salary for a full-time faculty member is $11,259. The faculty are supported by 21 administrative professionals and 29 other specialist and support professionals. Other personnel (secretarial, technical, etc.) number 56.

(5) The total cost of operating the College during 1973-74 was $4,925,550. Not surprisingly, the largest single component of this cost was attributable to Occupational and Vocational Instruction programs, which consumed $1,524,535 or about 30% of the School's total. Costs of $620,496 and $264,888 were associated with General Academic Instruction programs and Community Education programs, respectively. The cost of all the College's primary programs (i.e., Instruction and Public Service) was $2,461,693 or slightly less than half of Mountain's overall cost. Other costs resulted from operation of the College's various support programs, including Academic

Support (libraries, computer services, personnel development, etc.)--$358,664, Student Services--$786,677, Institutional Support (administration, physical plant, etc.)--$1,118,252, and Student Financial Aid--$179,855. As part of an analysis of costs conducted during the past year, the College examined the effects of dividing these various support costs (as well as certain capital costs) among the Instruction and Public Service programs that receive the support. As a result of the support cost allocation, the cost of Occupational and Vocational Instruction, for example, increased from $1,524,535 to $2,866,198. Complete results of this analysis are available from the College.

(6) The College's major revenue sources during 1973-74 were a state appropriation of $2,827,290 and tuition income of $1,154,234. Other sources of revenue included the federal government ($601,480), state contracts ($243,033), sales and services of auxiliary enterprises ($441,324), and endowment ($72,418). Further details on revenues as well as a complete statement of assets and liabilities are available from the College.

(7) One other aspect of the cost analysis noted above should be described in closing: the study of unit costs. This analysis was conducted for each of the College's departments and for each of its student degree programs. The units used as a basis were the credit hours taken by students in the department or major. Thus, for example, students took 5,813 credit hours in the Secretarial Department during the academic year. Since the direct cost of operating the Secretarial Department was found to be $91,647, a unit cost of $15.77 can be calculated ($91,547 divided by 5,813). A

*similar calculation was performed for each of the School's departments and for each type of major. Among departments, unit costs ranged from a high of $61.15 per student credit hour in Dental Technology to a low of $9.20 per student credit hour in Psychology. The highest unit cost for student degree programs was $48.21 for Dental Technology and the lowest was $13.53 in Supermarket Management. Once again, full details of this analysis are available from the College.*

*The material found in this summary is drawn from the results of a major study carried out by Mountain Community College during 1974. This study utilized a set of Information Exchange Procedures developed by the National Center for Higher Education Management Systems. Individuals interested in more detailed results of the study or other further information are encouraged to contact:*

*Mr. Mitchell Jamesner*
*Director of Institutional Research*
*Mountain Community College*
*Tencential, Colorado 12345*

Procedures and Guidelines

The principal purpose of the narrative institutional profile is to illustrate the content of an institution's IEP data set to prospective users of those data. The example given above should make it clear that the treatment of the data set is not exhaustive but illustrative. The profile is intended as a starting point or stimulus that will lead to more detailed examination and analysis of institutional IEP data by a broadened range of users. With this focus in mind, some procedural comments are warranted.

First, the institutional profile given here is only one example of how the highlights of an institution's IEP data might be translated into narrative. The particular institutions's environment, needs, and objectives will have a large impact on the precise narrative form it develops. The illustration chosen here, for example, does not include a description of research activities. Communicating the scope and range of a school's research work might well be a useful role for the narrative in certain contexts and for certain audiences. Other differences in narrative content and in emphasis also are possible. The basis point is that the institution should tailor the narrative to its own needs.

The second point to be made concerns the relationship between the information in the narrative and the IEP data formats. Table III.1 shows this relationship for the example given. Material from some of the data formats has not been explicitly included in the narrative, although a suggested location for such inclusion is indicated in parentheses. Establishing this relationship between data formats and portions of the narrative constitutes the only "procedure" involved in constructing the institutional narrative profile.

Table III.1

RELATIONSHIP BETWEEN THE PROTOTYPE INSTITUTIONAL NARRATIVE AND THE IEP DATA FORMATS

| Narrative Paragraph | IEP Data Format Source |
|---|---|
| 1. General | A.1, A.2, B.6 |
| 2. Student Characteristics | B.1, B.3, B.4 (B.2, B.5) |
| 3. Student Outcomes | F.1, F.2.1 (F.2.2) |
| 4. Personnel Resources | C.1, C.2 (C.3) |
| 5. Institutional Costs | D.1.1, D.1.2 (D.2) |
| 6. Revenue Sources | D.4 (D.3, D.5) |
| 7. Unit Costs | E.1, E.2 |

# IV

## PROFILES OF INSTRUCTIONAL DEPARTMENTS AND STUDENT PROGRAMS

For planning and management purposes, there are two instructional components of the institution that are of primary interest: the student (degree) program and the instructional organization unit. These components are conceptually distinct and may be described and analyzed separately, but they also hold an obvious close relationship with each other. In most institutions, it is the instructional organization unit (a discipline, department, division, or school) that is "managed," rather than the student program per se. But the organization unit exists very largely to provide the substance of student programs. Therefore, it is useful to be able to examine organization units and student programs, and the ways in which they interact. This section contains suggested profiles of these two institutional components.

The organization unit described here is the academic department; illustrations are given for two somewhat different departments: mathematics and business administration. Two examples of student programs also are given: one a mathematics BA/BS program and the other a business administration BA program. The examples given in this section are illustrated with data from a four-year institution that offers only the baccalaureate. Relatively minor modifications would be required for institutions offering associate degrees, certificates, and graduate degrees. These will be described in the comments following the profiles.

## A. Profiles of Instructional Departments

Purpose: The departmental profile is intended to provide a comprehensive picture of the IEP data associated with a particular organization unit--the department. There are three major elements of that picture: the department's resources, its activities, and its costs. The profiles may increase the capability for descriptive analysis across departments. Such comparative analysis should be helpful to both the department head, who wishes to examine his or her department in relation to others in the institution, and the division head or college dean, who needs information about several departments under his or her jurisdiction. More complex analytical use of the data presented in these profiles will be treated later in the sections on cost studies and enrollment trend analysis.

Prototype: The first table in this part is an overview of student credit hour production and direct costs for all disciplines of the example institution. Profiles of the mathematics and business administration departments then are presented for purposes of illustration. Each is assumed to be a single-discipline department that has at least one student program associated with it. The profiles are in three parts:

1. A summary of faculty personnel resources, their activities, and associated costs.
2. A summary of all costs in the department and the calculation of unit costs.

## Table IV.1

AN INSTITUTIONAL OVERVIEW OF ACTIVITIES AND COSTS FOR INSTRUCTIONAL DISCIPLINES, 1973-74

| Disciplines | Student Credit Hours | | Direct Costs | | |
|---|---|---|---|---|---|
| | Number | % of Institutional Total | Total $ | % of Institutional Total | Unit Cost |
| | (A) | (B) | (C) | (D) | (E) |
| Aerospace science | 1,604 | 0.6 | $ 40,100 | 0.6 | $25 |
| AF ROTC | 302 | 0.1 | 24,462 | 0.3 | 81 |
| Anthropology | 10,907 | 3.8 | 207,233 | 2.9 | 19 |
| Art | 14,175 | 5.0 | 297,675 | 4.2 | 21 |
| Biological Science | 9,099 | 3.2 | 209,277 | 2.9 | 23 |
| Botany | 1,369 | 0.5 | 39,701 | 0.6 | 29 |
| Business Administration | 17,286 | 6.1 | 276,576 | 3.9 | 16 |
| Business Education | 5,931 | 2.1 | 166,068 | 2.3 | 28 |
| Chemistry | 6,549 | 2.3 | 281,607 | 3.9 | 43 |
| Chinese | 198 | 0.1 | 5,742 | 0.1 | 29 |
| Communications | 1,379 | 0.5 | 33,096 | 0.5 | 24 |
| Computer Science | 683 | 0.2 | 28,003 | 0.4 | 41 |
| Drama | 2,988 | 1.0 | 98,604 | 1.4 | 33 |
| Economics | 5,947 | 2.1 | 184,357 | 2.6 | 31 |
| Education | 44,572 | 15.6 | 1,515,448 | 21.1 | 34 |
| English | 16,665 | 5.8 | 399,960 | 5.6 | 24 |
| Environmental Studies | 953 | 0.3 | 20,966 | 0.3 | 22 |
| Ethnic Studies | 2,011 | 0.7 | 68,374 | 1.0 | 34 |
| Exploratory Studies | 661 | 0.2 | 7,932 | 0.1 | 12 |
| French | 1,390 | 0.5 | 48,650 | 0.7 | 35 |
| Geography | 4,996 | 1.7 | 114,908 | 1.6 | 23 |
| Geology | 3,056 | 1.1 | 76,400 | 1.1 | 25 |
| German | 1,257 | 0.4 | 38,967 | 0.5 | 31 |
| Health | 6,155 | 2.2 | 110,790 | 1.5 | 18 |
| History | 9,462 | 3.3 | 198,702 | 2.8 | 21 |
| Home Economics | 7,799 | 2.7 | 194,975 | 2.7 | 25 |
| Humanities | 3,019 | 1.1 | 33,209 | 0.5 | 11 |
| Law and Justice | 1,010 | 0.4 | 28,280 | 0.4 | 28 |
| Leisure Studies | 2,809 | 1.0 | 64,607 | 0.9 | 23 |
| Mathematics | 12,435 | 4.4 | 261,135 | 3.6 | 21 |
| Music | 13,547 | 4.7 | 406,410 | 5.7 | 30 |
| Philosophy | 4,031 | 1.8 | 125,775 | 1.8 | 31 |
| Physical Education | 11,879 | 4.2 | 439,523 | 6.1 | 37 |
| Physics | 3,590 | 1.3 | 96,930 | 1.4 | 27 |
| Political Science | 4,112 | 1.4 | 106,912 | 1.5 | 26 |
| Psychology | 27,810 | 9.7 | 361,530 | 5.0 | 13 |
| Religious Studies | 185 | 0.1 | 3,145 | <0.1 | 17 |
| Safety Education | 326 | 0.1 | 12,062 | 0.2 | 37 |
| Social Science | 617 | 0.2 | 19,127 | 0.3 | 31 |
| Sociology | 13,157 | 4.6 | 210,512 | 2.9 | 16 |
| Spanish | 3,375 | 1.2 | 97,875 | 1.4 | 29 |
| Technical/Industrial Education | 3,229 | 1.1 | 138,847 | 1.9 | 43 |
| Zoology | 2,036 | 0.7 | 73,296 | 1.0 | 36 |
| INSTITUTIONAL TOTAL | 285,561 | 100.0* | $7,167,748 | 100.0* | |

*Detail may not add due to rounding.

Table IV.2

A PROFILE OF THE DEPARTMENT OF MATHEMATICS, 1973-74

Part 1. Faculty Resource Summary

A. Faculty Descriptors

| | Professor | Associate Professor | Assistant Professor | Graduate Assistant | Total |
|---|---|---|---|---|---|
| Head count | 3 | 4 | 4 | 7 | 18 |
| Full-time equivalents (FTE)* | 3 | 4 | 4 | 2.25 | 13.25 |
| Number on tenure | 3 | 3 | 0 | 0 | 6 |

B. Faculty Activities

| Activities | % Time | Student Credit Hours | Compensation Distribution | % Compensation |
|---|---|---|---|---|
| Scheduled teaching | | | | |
| 100 level | 45.26 | 10,494 | $ 91,113 | 42.35 |
| 200 level | 7.14 | 669 | 16,624 | 7.73 |
| 300 level | 6.93 | 687 | 15,620 | 7.26 |
| 400 + level | 19.92 | 585 | 46,554 | 21.64 |
| | 79.25 | 12,435 | $169,911 | 78.98 |
| Unscheduled teaching | 4.33 | | 6,393 | 2.97 |
| Academic advising | 1.20 | | 2,634 | 1.22 |
| Curriculum development | 1.20 | | 2,704 | 1.26 |
| Project research | 1.62 | | 3,353 | 1.56 |
| General activities | 2.14 | | 4,626 | 2.15 |
| Administrative duties | 4.95 | | 13,640 | 6.34 |
| Committees | 5.32 | | 11,897 | 5.53 |
| TOTAL | 100.00** | 12,435 | $215,158 | 100.00** |

Student Credit Hours/FTE: 938
Compensation $/FTE: $16,238

*The full-time equivalency for faculty is defined by the institution. Alternatively, the institution may use the "service months" figure taken from the Personnel Data Module.

**Detail may not add due to rounding.

3. A detailed presentation of the department's student credit hour (SCH) contribution to student programs and the costs associated with that contribution.

Procedures: All the information presented in the departmental profiles may be obtained from the computer printouts of the NCHEMS Costing and Data Management System. (Some of the information requires the exercise of institutional options that are not specifically a part of the IEP implementation procedures. These will be spelled out below.) The data are available either directly from the printed output of the software modules or through simple arithmetic operations such as the computation of percentages.

1. Table IV.1, the institutional overview, is simply a summary of credit hour production, direct costs, and the resulting unit costs for all disciplines. The data in columns A, C, and E come directly from the reports of the Data Management Module (DMM). The percentages in columns B and D may be computed manually or in DMM itself.

2. The information in Tables IV.2 and IV.5, Faculty Resource Summary, is obtained either from the Personnel Data Module (PDM) or from the Faculty Activity Module (FAM). If the institution has conducted an NCHEMS Faculty Activity Analysis,* the information may be taken directly from the Summary Activities Distribution Report of FAM.

*For detailed discussions of faculty activity analysis issues, procedures, and uses, see Romney, 1971; Manning and Romney, 1973; and Romney and Manning, 1974.

Table IV.3

A PROFILE OF THE DEPARTMENT OF MATHEMATICS, 1973-74

Part 2. Departmental Direct Cost Summary

| Object of Expenditure | Lower Division Courses | | Upper Division Courses | | Total | |
|---|---|---|---|---|---|---|
| | $ | % | $ | % | $ | % |
| 1. Personnel: | | | | | | |
| a. Faculty compensation | $136,410 | 76.4 | $78,748 | 95.2 | $215,158 | 82.3 |
| b. Other compensation | 25,208 | 14.1 | 2,388 | 2.9 | 27,596 | 10.6 |
| Subtotal | 161,618 | 90.5 | 81,136 | 98.1 | 242,754 | 92.9 |
| 2. Supplies and services and equipment | 16,990 | 9.5 | 1,544 | 1.9 | 18,534 | 7.1 |
| 3. TOTAL | $178,608 | 100.0 | $82,680 | 100.0 | $261,288 | 100.0 |
| 4. Student Credit Hours (SCH) | 11,163 | | 1,272 | | 12,435 | |
| 5. Direct Unit Cost ($/SCH) | $16 | | $65 | | $21 | |

If an activity analysis has not been conducted, the institutional options in PDM may be used to obtain the illustrated information or a subset of it. The institution may define a set of activities (or assignments) with which it can associate faculty resource use--through faculty data files, information from the department head, or some similar method. PDM then will accumulate the information for all faculty in the department and show the appropriate distribution of activity units (for example, student credit hours generated) and compensation.

In a similar manner, the "Person Type" codes in PDM may be used at the institution's discretion to produce the Faculty Descriptors in Table IV.2. The institution may define a set of codes to describe distinct subsets of faculty and the resources associated with them. The codes may be used to define faculty rank, sex, tenure status, and the like, and information may be aggregated according to these variables or combinations of them.

3. The data in Tables IV.3 and IV.6, Departmental Direct Cost Summary, are obtained from the unit cost and cost by object reports of the Data Management Module. The accumulation of departmental direct costs by object of expenditure is an institutional option in IEP--one that many institutions will choose not to exercise. In these cases it will be possible to show only two cost components: faculty compensation (or

Table IV.4

A PROFILE OF THE DEPARTMENT OF MATHEMATICS, 1973-74

Part 3. Contribution of the Mathematics Department to Student Programs

| Student Programs | Student Credit Hours | | | | Direct Costs | | | |
|---|---|---|---|---|---|---|---|---|
| | LOWER DIVISION | UPPER DIVISION | TOTAL | % OF DEPARTMENTAL TOTAL | LOWER DIVISION | UPPER DIVISION | TOTAL | % OF DEPARTMENTAL TOTAL |
| | (A) | (B) | (C) | (D) | (E) | (F) | (G) | (H) |
| Administration, Management | 15 | | 15 | 0.1 | $ 240 | | $ 240 | 0.1 |
| Anthropology | 15 | 12 | 27 | .2 | 240 | $ 780 | 1,020 | .4 |
| Art | 153 | | 153 | 1.2 | 2,448 | | 2,448 | .9 |
| Biology | 150 | 120 | 270 | 2.2 | 2,400 | 7,800 | 10,200 | 3.9 |
| Botany | 45 | 15 | 60 | .5 | 720 | 975 | 1,695 | .6 |
| Business Administration | 948 | 60 | 1,008 | 8.1 | 15,168 | 3,900 | 19,068 | 7.3 |
| Business Education | 54 | | 54 | .4 | 864 | | 864 | .3 |
| Chemistry | 72 | 40 | 112 | .9 | 1,152 | 2,600 | 3,752 | 1.4 |
| Communication and Speech | 96 | | 96 | .8 | 1,536 | | 1,536 | .6 |
| Education | 651 | 57 | 708 | 5.7 | 10,416 | 3,705 | 14,121 | 5.4 |
| English | 168 | | 168 | 1.3 | 2,688 | | 2,688 | 1.0 |
| Geography | 12 | | 12 | .1 | 192 | | 192 | .1 |
| Geology | 105 | 30 | 135 | 1.0 | 1,680 | 1,950 | 3,630 | 1.4 |
| History | 108 | 9 | 117 | .9 | 1,728 | 585 | 2,313 | .9 |
| Home Economics | 51 | | 51 | .4 | 816 | | 816 | .3 |
| Industrial Technology | 57 | 15 | 72 | .6 | 912 | 975 | 1,887 | .7 |
| Interdepartmental Studies | 72 | 9 | 81 | .7 | 1,152 | 585 | 1,737 | .7 |
| Leisure Services | 57 | | 57 | .5 | 912 | | 912 | .3 |
| Mass Media | 30 | | 30 | .2 | 480 | | 480 | .2 |
| Math--BA/BS | 87 | 216 | 303 | 2.4 | 1,392 | 14,040 | 15,432 | 5.9 |
| Math--BA-Ed | 159 | 258 | 417 | 3.4 | 2,544 | 16,770 | 19,314 | 7.4 |
| Music | 237 | | 237 | 1.9 | 3,792 | | 3,792 | 1.5 |
| Philosophy | 12 | | 12 | .1 | 192 | | 192 | .1 |
| Physical Education and Health | 255 | 12 | 267 | 2.1 | 4,080 | 780 | 4,860 | 1.9 |
| Physics | 90 | 38 | 128 | 1.0 | 1,440 | 2,470 | 3,910 | 1.5 |
| Political Science | 105 | 9 | 114 | .9 | 1,680 | 585 | 2,265 | .9 |
| Pre-Professional | 633 | 12 | 645 | 5.2 | 10,128 | 780 | 10,908 | 4.2 |
| Psychology | 225 | | 225 | 1.8 | 3,600 | | 3,600 | 1.4 |
| Sociology | 108 | | 108 | .9 | 1,728 | | 1,728 | .7 |
| Spanish | 15 | | 15 | .1 | 240 | | 240 | .1 |
| Theater and Drama | 12 | | 12 | .1 | 192 | | 192 | .1 |
| Zoology | 30 | | 30 | .2 | 480 | | 480 | .2 |
| Undecided | 6,336 | 360 | 6,696 | 53.8 | 101,376 | 23,400 | 124,776 | 47.8 |
| DEPARTMENTAL TOTAL | 11,163 | 1,272 | 12,435 | 100.0* | $178,608 | $82,680 | $261,288 | 100.0* |

*Detail may not add due to rounding.

Table IV.5

A PROFILE OF THE DEPARTMENT OF BUSINESS ADMINISTRATION, 1973-74

Part 1. Faculty Resource Summary

A. Faculty Descriptors

| | Professor | Associate Professor | Assistant Professor | Instructor/ Lecturer | Total |
|---|---|---|---|---|---|
| Headcount | 3 | 3 | 7 | 9 | 22 |
| Full-time equivalents* | 3 | 3 | 6 | 2.6 | 14.6 |
| Number on tenure | 3 | 3 | 0 | 0 | 6 |

B. Faculty Activities

| Activities | % Time | Student Credit Hours | Compensation Distribution | % Compensation |
|---|---|---|---|---|
| Scheduled teaching | | | | |
| 200 level | 13.72 | 5,835 | $ 29,767 | 12.37 |
| 300 level | 25.54 | 8,775 | 66,567 | 27.66 |
| 400 + level | 27.06 | 2,676 | 60,803 | 25.26 |
| | 66.32 | 17,286 | 157,137 | 65.29 |
| Unscheduled teaching | 1.88 | | 4,308 | 1.79 |
| Academic advising | 6.75 | | 16,298 | 6.77 |
| Curriculum development | 3.28 | | 7,524 | 3.13 |
| Project research | 7.90 | | 19,300 | 8.02 |
| Student service | 0.20 | | 304 | 0.13 |
| Administrative duties | 4.34 | | 11,907 | 4.95 |
| Committees | 5.86 | | 15,418 | 6.41 |
| Public service | 3.48 | | 8,465 | 3.52 |
| TOTAL | 100.00** | 17,286 | $240,661 | 100.00** |

Student Credit Hours/FTE: 1184
Compensation $/FTE: $16,484

*The full-time equivalency for faculty is defined by the institution. Alternatively, the institution may use the "service months" figure taken from the Personnel Data Module.

**Detail may not add due to rounding.

faculty salaries) from PDM, and all other departmental direct costs. It will not be possible to show line 1.b and line 2 separately in the table. It will be seen in Section V, however, that for cost analysis purposes there may be considerable advantage in the the ability to examine costs by object of expenditure.

4. Part 3, departmental contributions to student programs (Tables IV.4 and IV.7), is central to the profiles of instructional departments. The information here is taken from the discipline contribution reports of the Student Data Module (SDM) and the unit cost reports of DMM. The institution has the option--and is encouraged to exercise it--of combining the two data types (credit hours and costs) in a single DMM report to produce columns A, B, C, E, F, and G. The percentages in columns D and H are again produced manually or in the Data Management Module.

Comments: 1. Tables IV.1, IV.4, and IV.7 all contain data from the Student Data Module, which has four dimensions: discipline, course level, student program, and student level. In our examples, for the sake of brevity, we have used only three of those dimensions--we have not shown student levels within the student programs supported by each department. That fourth dimension can easily be added, and for most analyses--whether they are simply descriptive or are more complex--it should be added.

Table IV.6

A PROFILE OF THE DEPARTMENT OF BUSINESS ADMINISTRATION, 1973-74

Part 2. Departmental Direct Cost Summary

| Object of Expenditure | Lower Division Courses $ | Lower Division Courses % | Upper Division Courses $ | Upper Division Courses % | Total $ | Total % |
|---|---|---|---|---|---|---|
| 1. Personnel: | | | | | | |
| a. Faculty compensation | $45,484 | 78.0 | $195,177 | 89.7 | $240,661 | 87.2 |
| b. Other compensation | 7,513 | 12.9 | 13,654 | 6.3 | 21,167 | 7.7 |
| Subtotal | 52,997 | 90.9 | 208,831 | 96.0 | 261,828 | 94.9 |
| 2. Supplies and services and equipment | 5,353 | 9.1 | 8,738 | 4.0 | 14,091 | 5.1 |
| 3. TOTAL | $58,350 | 100.0 | $217,569 | 100.0 | $275,919 | 100.0 |
| 4. Student Credit Hours (SCH) | 5,835 | | 11,451 | | 17,286 | |
| 5. Direct Unit Cost ($/SCH) | $10 | | $19 | | $16 | |

## Table IV.7

A PROFILE OF THE DEPARTMENT OF BUSINESS ADMINISTRATION, 1973-74

Part 3. Contribution of the Business Administration Department to Student Programs

| Student Programs | Student Credit Hours | | | | Direct Costs | | | |
|---|---|---|---|---|---|---|---|---|
| | LOWER DIVISION | UPPER DIVISION | TOTAL | % OF DEPART-MENTAL TOTAL | LOWER DIVISION | UPPER DIVISION | TOTAL | % OF DEPART-MENTAL TOTAL |
| | (A) | (B) | (C) | (D) | (E) | (F) | (G) | (H) |
| Administration, Management | 75 | 270 | 345 | 2.0 | $ 750 | $ 5,130 | $ 5,880 | 2.1 |
| Biology | 45 | 21 | 66 | .4 | 450 | 399 | 849 | .3 |
| Business Administration | 2,340 | 6,735 | 9,075 | 52.5 | 23,400 | 127,965 | 151,365 | 55.1 |
| Business Education | 60 | 15 | 75 | .4 | 600 | 285 | 885 | .3 |
| Communication and Speech | 15 | | 15 | .1 | 150 | | 150 | .1 |
| Education | 45 | 75 | 120 | .7 | 450 | 1,425 | 1,875 | .7 |
| English | 45 | | 45 | .3 | 450 | | 450 | .2 |
| Geography | | 15 | 15 | .1 | | 285 | 285 | .1 |
| Geology | 15 | | 15 | .1 | 150 | | 150 | .1 |
| Home Economics | 60 | 30 | 90 | .5 | 600 | 570 | 1,170 | .4 |
| Industrial Technology | | 60 | 60 | .3 | | 1,140 | 1,140 | .4 |
| Interdepartmental Studies | 30 | 150 | 180 | 1.0 | 300 | 2,850 | 3,150 | 1.1 |
| Law and Justice | | 60 | 60 | .3 | | 1,140 | 1,140 | .4 |
| Leisure Services | 45 | 105 | 150 | .9 | 450 | 1,995 | 2,445 | .9 |
| Mass Media | 15 | 30 | 45 | .3 | 150 | 570 | 720 | .3 |
| Math | 75 | 30 | 105 | .6 | 750 | 570 | 1,320 | .5 |
| Philosophy | | 45 | 45 | .3 | | 855 | 855 | .3 |
| Physical Education | | 45 | 45 | .3 | | 855 | 855 | .3 |
| Political Science | 30 | 45 | 75 | .4 | 300 | 855 | 1,155 | .4 |
| Pre-Professional | 150 | 90 | 240 | 1.4 | 1,500 | 1,710 | 3,210 | .7 |
| Psychology | | 15 | 15 | .1 | | 285 | 285 | .1 |
| Sociology | | 105 | 105 | .6 | | 1,995 | 1,995 | .7 |
| Zoology | | 15 | 15 | .1 | | 285 | 285 | .1 |
| Undecided | 2,790 | 3,495 | 6,285 | 36.4 | 27,900 | 66,405 | 94,305 | 34.3 |
| DEPARTMENTAL TOTAL | 5,835 | 11,448 | 17,286 | 100.0* | $58,350 | $217,569 | $275,919 | 100.0* |

*Detail may not add due to rounding.

2. Similarly, it will be recalled that the examples use illustrative data from a four-year baccalaureate institution. In institutions with graduate courses and graduate programs, the necessary additions must be made to both course level and student level.

3. The institutional overview in Table IV.1 contains information that is found also in Format E.1 of the IEP Data Formats and Definitions. It should be noted, however, that in the data formats all instructional activities are shown in terms of semester credit hours or their equivalent. This standardization is necessary to produce data that are compatible across institutions. For intrainstitutional purposes, if another standard is used (such as quarter credits in the example shown here), it is not necessary and probably not desirable to convert to semester credit equivalents.

4. Throughout the examples given here, direct costs have been used for illustration of the profiles. This has been done since it is direct costs, rather than full costs, over which the head of the instructional organization unit is likely to be able to exercise some discretion. It should be noted, however, that the full costs calculated and reported in DMM may easily be attached as additional columns to the institutional overview table and the department profiles.

5. In part 1.B of each profile (Tables IV.2 and IV.5) a summary is given of the activities of all faculty in the department. For some purposes involving departmental planning or the analysis of faculty resource use, the department head will want to examine activity distributions for subsets of faculty (perhaps by rank) or even for individual faculty members. Either of these options may be exercised in the Faculty Activity Module or the Personnel Data Module (see Procedure 2 above). Such examination might show, for example, that some activities were not "allowed" as costable, or that the amount of time actually spent on special kinds of activities did not match well with the amount of released time allocated for them. (Effects such as these are reflected in the fact that the time distributions are not identical to the compensation distributions in Tables IV.2 and IV.5.)

6. The same kind of profile that has been presented here for a department also may be constructed for higher level organization units (such as the College of Arts and Science) or for groups of disciplines that are felt to be similar in terms of their content, their instructional methodology, their student clientele, or other factors of interest. The summary information needed is obtained easily by requesting appropriate aggregations of data in the reports of the Data Management Module.

7. The information given in the sample profiles is all for a single time period, but some of the most useful applications of IEP data (or other data sets) may rely on the availability of the information over several time periods. This kind of comparative analysis over time is discussed in Section VII. The reader also may want to keep in mind its applicability to some of the analyses described in the intervening sections.

## Planning and Management Applications

The departmental profiles illustrated here, and the variations described in Comment 6, contain information used in many of the analytical studies procedures described in Sections V and VII of this manual. Even without those more detailed analyses, however, the profiles are useful as descriptive summaries of information about the magnitude of teaching activity, the mix and cost of teaching activities by level, the relative magnitude of teaching and other activities conducted by the faculty, and the credit hour and dollar contribution of the department to the institution's student programs.

The profiles may thus be used for addressing the following kinds of planning and resource allocation concerns:*

- Resource utilization at different course levels and for different activities.
- Differences in productivity--between departments or for the same department over time.

*For a detailed and intensive treatment of departmental planning, the reader is referred to Miyataki and Gray, 1975.

- Potential effects on the department of student program shifts. (To what extent does the department act in a service mode, relying on "consumers" outside the department? Does it have a strong clientele group involved in its own student program?)
- Examination of costs. (To what extent does the department have the capability to reduce costs, especially when demand goes down? How close is it to being locked in by tenure?)
- Where can resources be shifted to achieve the most beneficial productivity levels at reasonable cost to the institution? Is there an unexpected disparity between lower and upper division resource use, or among related disciplines that were assumed to be similar?

In the aggregate, these profiles also describe the most important and probably the largest component of the work of the institution: its instructional activities. They may therefore be useful for examining the manner in which the institution carries out its mission and seeks to achieve its goals.

## B. Profiles of Student Programs

Purpose: The student program profiles are constructed so that the user may examine at one time all IEP data associated with a particular student degree program or group of programs. Data are obtained from both the IEP data formats and the computer printouts of the NCHEMS Costing and Data Management System. The profiles are intended to give a well-rounded picture of the student program with respect to its size, student course consumption across disciplines, drop-out rates, program completion measures, characteristics of program completers, and measures of student outcomes. In addition, they provide a limited picture of student program costs. (The limitations will be discussed in the Comments section following the profiles.)

The use of these profiles in institutional analysis is illustrated in the sections on cost and outcomes studies and trend analysis. The profiles also are helpful in providing information for the close examination of a single student program or group of programs, and for the comparison of programs across the institution.

Prototype: The first table in this section is an overview of the institution's student programs, similar to that given for departments in Table IV.1 above. This is followed by student program profiles in three parts:

Table IV.8

AN INSTITUTIONAL OVERVIEW OF ACTIVITIES AND COSTS FOR STUDENT PROGRAMS, 1973-74

| Student Programs | Enrollments | | | Program Completers | | Direct Costs | | |
|---|---|---|---|---|---|---|---|---|
| | Full-Time Equivalents | % of Institutional Total | % of Declared Majors | Headcount Number | % of Institutional Total | Total $ | % of Institutional Total | Unit Cost $/SCH |
| | (A) | (B) | (C) | (D) | (E) | (F) | (G) | (H) |
| Administration, Management | 46 | 0.7 | 1.3 | 28 | 1.7 | $ 57,546 | 0.8 | $28 |
| Anthropology | 46 | 0.7 | 1.3 | 20 | 1.2 | 53,820 | 0.8 | 26 |
| Art | 228 | 3.6 | 6.4 | 103 | 6.3 | 257,566 | 3.6 | 25 |
| Biology | 124 | 2.0 | 3.5 | 65 | 4.0 | 178,560 | 2.5 | 32 |
| Botany | 15 | 0.2 | 0.4 | 6 | 0.4 | 18,833 | 0.3 | 28 |
| Business Administration | 419 | 6.7 | 11.8 | 178 | 10.9 | 409,968 | 5.8 | 22 |
| Business Education | 27 | 0.4 | 0.8 | 17 | 1.0 | 30,375 | 0.4 | 25 |
| Chemistry | 21 | 0.3 | 0.6 | 9 | 0.6 | 38,745 | 0.5 | 41 |
| Communication and Speech | 46 | 0.7 | 1.3 | 25 | 1.5 | 60,030 | 0.8 | 29 |
| Economics | 32 | 0.5 | 0.9 | 18 | 1.1 | 34,560 | 0.5 | 24 |
| Education | 511 | 8.2 | 14.4 | 197 | 12.0 | 538,083 | 7.6 | 23 |
| English | 150 | 2.4 | 4.2 | 63 | 3.9 | 183,600 | 2.6 | 27 |
| French | 14 | 0.2 | 0.4 | 8 | 0.5 | 20,790 | 0.3 | 33 |
| Geography | 33 | 0.5 | 0.9 | 17 | 1.0 | 43,065 | 0.6 | 29 |
| Geology | 19 | 0.3 | 0.5 | 12 | 0.7 | 29,070 | 0.4 | 34 |
| German | 12 | 0.2 | 0.3 | 5 | 0.3 | 21,060 | 0.3 | 39 |
| History | 128 | 2.0 | 3.6 | 53 | 3.2 | 155,520 | 2.2 | 27 |
| Home Economics | 174 | 2.8 | 4.9 | 96 | 5.9 | 203,580 | 2.9 | 26 |
| Industrial Technology | 94 | 1.5 | 2.6 | 51 | 3.1 | 149,742 | 2.1 | 35 |
| Interdepartmental Studies | 7 | 0.1 | 0.2 | 2 | 0.1 | 11,655 | 0.2 | 37 |
| Language Arts | 88 | 1.4 | 2.5 | 41 | 2.5 | 123,948 | 1.8 | 31 |
| Law and Justice | 8 | 0.1 | 0.2 | 2 | 0.1 | 11,520 | 0.2 | 32 |
| Leisure Services | 74 | 1.2 | 2.1 | 33 | 2.0 | 62,271 | 0.9 | 19 |
| Mass Media | 29 | 0.5 | 0.8 | 13 | 0.8 | 37,845 | 0.5 | 29 |
| Math--BA/BS | 19 | 0.3 | 0.5 | 9 | 0.6 | 31,830 | 0.5 | 38 |
| Math--BA-Ed | 30 | 0.5 | 0.8 | 18 | 1.1 | 48,927 | 0.7 | 37 |
| Music | 211 | 3.4 | 5.9 | 113 | 6.9 | 317,927 | 4.5 | 33 |
| Philosophy | 13 | 0.2 | 0.4 | 3 | 0.2 | 18,135 | 0.3 | 31 |
| Physical Education and Health | 297 | 4.7 | 8.3 | 138 | 8.4 | 364,864 | 5.2 | 27 |
| Physics | 19 | 0.3 | 0.5 | 10 | 0.6 | 26,505 | 0.4 | 31 |
| Political Science | 88 | 1.4 | 2.5 | 37 | 2.3 | 115,632 | 1.6 | 29 |
| Pre-Professional | 37 | 0.6 | 1.0 | 16 | 1.0 | 63,270 | 0.9 | 38 |
| Psychology | 221 | 3.5 | 6.2 | 97 | 5.9 | 218,790 | 3.1 | 22 |
| Sociology | 186 | 3.0 | 5.2 | 88 | 5.4 | 276,210 | 3.9 | 33 |
| Spanish | 27 | 0.4 | 0.8 | 14 | 0.9 | 34,020 | 0.5 | 28 |
| Theater and Drama | 41 | 0.7 | 1.2 | 23 | 1.4 | 59,040 | 0.8 | 32 |
| Zoology | 24 | 0.4 | 0.7 | 9 | 0.6 | 36,720 | 0.5 | 34 |
| Undecided | 2698 | 43.1 | --- | -- | --- | 2,719,584 | 38.5 | 22 |
| INSTITUTIONAL TOTAL | 6256 | 100.0* | 100.0* | 1637 | 100.0* | $7,063,166 | 100.0* | |

*Detail may not add due to rounding.

- Student program credit hour consumption, by discipline.
- A student program activity and cost summary.
- A student outcomes summary.

Each of the first two parts is illustrated with data from two different student programs, a mathematics program and a business administration program. This will give the reader an opportunity to make comparisons between programs. To avoid overburdening the reader with tables, however, a single illustration of the student outcomes summary (the third part) is given for the business administration program.

Procedures: The information in the student program profiles is obtained from Format F.1 of the IEP data formats and from two modules of the NCHEMS Costing and Data Management System, the Student Outcomes Module (SOM) and the Data Management Module (DMM). The data are available either directly from the computer printouts or through simple arithmetic operations on the printed data.

1. Table IV.8 is a summary of student enrollments, program completions, and direct costs for all identifiable student degree programs in the institution. Columns A, F, and H are taken from the program unit cost reports of DMM. In those reports, the enrollments (Column A) will usually be given in terms of credit hours rather than student FTE. It will probably be of benefit to convert this measure to FTE

Table IV.9

A PROFILE OF THE MATHEMATICS BA/BS PROGRAM, 1973-74

Part 1. Student Program Credit Hour Consumption, by Discipline

| Disciplines | | Student Credit Hours | | | | Direct Costs | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | LOWER DIVISION | UPPER DIVISION | TOTAL | % OF PROGRAM TOTAL | LOWER DIVISION | UPPER DIVISION | TOTAL | % OF PROGRAM TOTAL |
| | | (A) | (B) | (C) | (D) | (E) | (F) | (G) | (H) |
| Aerospace | (25)* | 12 | | 12 | 1.4 | $ 300 | | $ 300 | 0.9 |
| AF ROTC | (81) | 6 | | 6 | .7 | 486 | | 486 | 1.5 |
| Art | (21) | | 12 | 12 | 1.4 | | $ 252 | 252 | .8 |
| Biological Science | (23) | | 21 | 21 | 2.5 | | 483 | 483 | 1.5 |
| Business Administration | (16) | | 30 | 30 | 3.6 | | 480 | 480 | 1.5 |
| Business Education | (28) | | | | | | | | |
| Chemistry | (43) | 15 | 12 | 27 | 3.2 | 645 | 516 | 1,161 | 3.6 |
| Communications | (24) | | | | | | | | |
| Computer Science | (41) | 12 | 60 | 72 | 8.6 | 492 | 2,460 | 2,952 | 9.3 |
| Economics | (31) | | | | | | | | |
| Education | (34) | | 12 | 12 | 1.4 | | 408 | 408 | 1.3 |
| English | (24) | 15 | 9 | 24 | 2.9 | 360 | 216 | 576 | 1.8 |
| French | (35) | | | | | | | | |
| Geography | (23) | 15 | | 15 | 1.8 | 345 | | 345 | 1.1 |
| Geology | (25) | 48 | | 48 | 5.7 | 1,200 | | 1,200 | 3.8 |
| German | (31) | 24 | 15 | 39 | 4.7 | 744 | 465 | 1,209 | 3.8 |
| Health Education | (18) | | | | | | | | |
| History | (21) | | | | | | | | |
| Home Economics | (25) | | 12 | 12 | 1.4 | | 300 | 300 | .9 |
| Math | (LD 16, UD 65) | 57 | 246 | 303 | 36.2 | 912 | 15,990 | 16,902 | 53.1 |
| Music | (30) | | | | | | | | |
| Philosophy | (25) | | 12 | 12 | 1.4 | | 300 | 300 | .9 |
| Physical Education | (37) | 15 | 3 | 18 | 2.2 | 555 | 111 | 666 | 2.1 |
| Physics | (27) | 39 | 48 | 87 | 10.4 | 1,053 | 1,296 | 2,349 | 7.4 |
| Political Science | (26) | 15 | | 15 | 1.8 | 390 | | 390 | 1.2 |
| Psychology | (13) | 15 | 12 | 27 | 3.2 | 195 | 156 | 351 | 1.1 |
| Social Science | (25) | | | | | | | | |
| Sociology | (16) | 15 | 30 | 45 | 5.4 | 240 | 480 | 720 | 2.3 |
| Spanish | (29) | | | | | | | | |
| Tech./Ind. Education | (43) | | | | | | | | |
| PROGRAM TOTAL | | 303 | 534 | 837 | 100.0** | $7,917 | $23,913 | $31,830 | 100.0** |

*Numbers in parentheses are discipline unit costs ($/SCH), with lower division and upper division costs averaged for purposes of illustration, except in math where they are shown separately.

**Detail may not add due to rounding.

Table IV.10

A PROFILE OF THE MATHEMATICS BA/BS PROGRAM, 1973-74

Part 2. Student Program Activity and Cost Summary

| | Activity or Cost Measure | Lower Division | Upper Division | Program Total |
|---|---|---|---|---|
| 1. | Total SCH | 303 | 534 | 837 |
| 2. | FTE students* | 6.73 | 11.87 | 18.6 |
| 3. | Headcount students | 6 | 11 | 17 |
| 4. | SCH/Headcount | 50.5 | 48.5 | 49.2 |
| 5. | Total direct costs | $7,917 | $23,913 | $31,830 |
| 6. | Direct cost/SCH | 26.13 | 44.78 | 38.03 |
| 7. | Direct cost/FTE | 1,176 | 2,015 | 1,711 |
| 8. | Direct cost/Headcount | 1,320 | 2,174 | 1,872 |
| 9. | Total full costs | $14,488 | $42,804 | $57,292 |
| 10. | Full cost/SCH | 47.82 | 80.16 | 68.45 |
| 11. | Full cost/FTE | 2,153 | 3,606 | 3,080 |
| 12. | Full cost/Headcount | 2,415 | 3,891 | 3,370 |
| 13. | Total full costs/direct costs | 1.83 | 1.79 | 1.80 |

*Student FTE will be defined by the institution. The example given here is based on 1 FTE = 45 SCH in quarter credits.

Table IV.11

A PROFILE OF THE BUSINESS ADMINISTRATION BA PROGRAM, 1973-74

Part 1. Student Program Credit Hour Consumption, by Discipline

| Disciplines | | Student Credit Hours | | | | Direct Costs | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | LOWER DIVISION | UPPER DIVISION | TOTAL | % OF PROGRAM TOTAL | LOWER DIVISION | UPPER DIVISION | TOTAL | % OF PROGRAM TOTAL |
| | | (A) | (B) | (C) | (D) | (E) | (F) | (G) | (H) |
| Aerospace | (25)* | 54 | 60 | 114 | 0.6 | $ 1,350 | $ 1,500 | $ 2,850 | 0.7 |
| AF ROTC | (81) | | 33 | 33 | .2 | | 2,673 | 2,673 | .7 |
| Art | (21) | 96 | 165 | 261 | 1.4 | 2,016 | 3,465 | 5,481 | 1.3 |
| Anthropology | (19) | 168 | 84 | 252 | 1.3 | 3,192 | 1,596 | 4,788 | 1.2 |
| Biological Science | (23) | 150 | 72 | 222 | 1.2 | 3,450 | 1,656 | 5,106 | 1.2 |
| Botany | (29) | 15 | | 15 | .1 | 435 | | 435 | .1 |
| Business Administration (LD 10, UD 19) | | 1,800 | 7,059 | 8,859 | 46.9 | 18,000 | 134,121 | 152,121 | 37.1 |
| Business Education | (28) | 144 | 186 | 330 | 1.8 | 4,032 | 5,208 | 9,240 | 2.3 |
| Chemistry | (43) | 120 | 114 | 234 | 1.2 | 5,160 | 4,902 | 10,062 | 2.5 |
| Chinese | (29) | | 15 | 15 | .1 | | 435 | 435 | .1 |
| Communications | (24) | 72 | 138 | 210 | 1.1 | 1,728 | 3,312 | 5,040 | 1.2 |
| Computer Science | (41) | 24 | 144 | 168 | .9 | 984 | 5,904 | 6,888 | 1.7 |
| Drama | (33) | 69 | 12 | 81 | .4 | 2,277 | 396 | 2,673 | .7 |
| Economics | (31) | 735 | 1,185 | 1,920 | 10.2 | 22,785 | 36,735 | 59,520 | 14.5 |
| Education | (34) | 21 | 45 | 66 | .4 | 714 | 1,530 | 2,244 | .5 |
| English | (24) | 222 | 291 | 513 | 2.7 | 5,328 | 6,984 | 12,312 | 3.0 |
| Environmental Studies | (22) | 15 | 90 | 105 | .6 | 330 | 1,980 | 2,310 | .6 |
| Ethnic Studies | (34) | 15 | 54 | 69 | .4 | 510 | 1,836 | 2,346 | .6 |
| Exploratory Studies | (12) | | 12 | 12 | .1 | | 144 | 144 | <.1 |
| French | (35) | | 9 | 9 | <.1 | | 315 | 315 | .1 |
| Geography | (23) | 132 | 81 | 213 | 1.1 | 3,036 | 1,863 | 4,899 | 1.2 |
| Geology | (25) | 129 | 63 | 192 | 1.0 | 3,225 | 1,575 | 4,800 | 1.2 |
| German | (31) | 15 | 30 | 45 | .2 | 465 | 930 | 1,395 | .3 |
| Health | (18) | 114 | 51 | 165 | .9 | 2,052 | 918 | 2,970 | .7 |
| History | (21) | 195 | 129 | 324 | 1.7 | 4,095 | 2,709 | 6,804 | 1.7 |
| Home Economics | (25) | 81 | 66 | 147 | .8 | 2,025 | 1,650 | 3,675 | .9 |
| Humanities | (11) | 165 | 54 | 219 | 1.2 | 1,815 | 594 | 2,409 | .6 |
| Law and Justice | (28) | 12 | 51 | 63 | .3 | 336 | 1,428 | 1,764 | .4 |
| Leisure Services | (23) | | 45 | 45 | .2 | | 1,035 | 1,035 | .3 |
| Mathematics | (21) | 624 | 369 | 993 | 5.3 | 13,104 | 7,749 | 20,853 | 5.1 |
| Music | (30) | 168 | 195 | 363 | 1.9 | 5,040 | 5,850 | 10,890 | 2.7 |
| Philosophy | (25) | 12 | 84 | 96 | .5 | 300 | 2,100 | 2,400 | .6 |
| Physical Education | (37) | 279 | 297 | 576 | 3.0 | 10,323 | 10,989 | 21,312 | 5.2 |
| Physics | (27) | | 45 | 45 | .2 | | 1,215 | 1,215 | .3 |
| Political Science | (26) | 90 | 60 | 150 | .8 | 2,340 | 1,560 | 3,900 | 1.0 |
| Psychology | (13) | 426 | 387 | 813 | 4.3 | 5,538 | 5,031 | 10,569 | 2.6 |
| Religious Studies | (17) | | 12 | 12 | .1 | | 204 | 204 | <.1 |
| Safety Education | (37) | 18 | 9 | 27 | .1 | 666 | 333 | 999 | .2 |
| Sociology | (16) | 294 | 294 | 588 | 3.1 | 4,704 | 4,704 | 9,408 | 2.3 |
| Spanish | (29) | 84 | 54 | 138 | .7 | 2,436 | 1,566 | 4,002 | 1.0 |
| Tech./Ind. Education | (43) | 72 | 102 | 174 | .9 | 3,096 | 4,386 | 7,482 | 1.8 |
| PROGRAM TOTAL | | 6,630 | 12,246 | 18,876 | 100.0** | $136,887 | $273,081 | $409,968 | 100.0** |

*Numbers in parentheses are discipline unit costs ($/SCH), with lower division and upper division costs averaged for purposes of illustration, except in business administration where they are shown separately.

**Detail may not add due to rounding.

(using the institution's definition) for comparison with the program completion measure. The FTE figures in Column A may be found also in the program enrollments report of DMM. Column D of Table IV.8 contains data from Format F.1 of the IEP data formats.

Two different percentage distributions of enrollments are given in Columns B and C. The percentages in Column B are calculated on the basis of <u>total</u> enrollments (6256 in the illustration), while those in Column C are calculated on the basis of <u>declared majors</u> (6256 - 2698 undecided = 3558 in the illustration). The second of these is probably more appropriate for comparison with the program completion figures in Column E. All of the percentages (Columns B, C, E, and G) may be computed manually or in the Data Management Module.

2. Tables IV.9 and 11 show the pattern of student credit hour consumption, by each of the two student programs, across all the disciplines of the institution, and the associated direct costs. They may be considered the counterpart of Tables IV.4 and IV.7 in the departmental profiles. The data are taken from the program unit cost reports of DMM. As above, the percentages in Columns D and H of each table may be calculated manually or by computer.

Table IV.12

A PROFILE OF THE BUSINESS ADMINISTRATION BA PROGRAM, 1973-74

Part 2. Student Program Activity and Cost Summary

| | Activity or Cost Measure | Lower Division | Upper Division | Program Total |
|---|---|---|---|---|
| 1. | Total SCH | 6,630 | 12,246 | 18,876 |
| 2. | FTE students* | 147.33 | 272.13 | 419.46 |
| 3. | Headcount students | 144 | 266 | 410 |
| 4. | SCH/Headcount | 46.0 | 46.0 | 46.0 |
| 5. | Total direct costs | $136,887 | $273,081 | $409,968 |
| 6. | Direct cost/SCH | 20.65 | 22.30 | 21.72 |
| 7. | Direct cost/FTE | 929 | 1,003 | 977 |
| 8. | Direct cost/Headcount | 951 | 1,027 | 1,000 |
| 9. | Total full costs | $239,552 | $483,353 | $722,905 |
| 10. | Full cost/SCH | 36.13 | 39.47 | 38.30 |
| 11. | Full cost/FTE | 1,626 | 1,776 | 1,723 |
| 12. | Full cost/Headcount | 1,664 | 1,817 | 1,763 |
| 13. | Total full costs/direct costs | 1.75 | 1.77 | 1.76 |

*Student FTE will be defined by the institution. The example given here is based on 1 FTE = 45 SCH in quarter credits.

Table IV.13

STUDENT OUTCOMES SUMMARY: BUSINESS ADMINISTRATION BA PROGRAM, 1973-74

A. Enrollments, Program Completions, and Exiting Students

| | |
|---|---|
| 1. Fall term headcount enrollment | |
| Lower division | 144 |
| Upper division | 266 |
| Total | 410 |
| 2. a. Program completers for the fiscal year | 178 |
| b. Ratio of program completers to enrollment | .434 |

| 3. a. Exiting students (noncompleters) for fiscal year | Lower Division | Upper Division | Total |
|---|---|---|---|
| | 10 | 16 | 26 |
| b. Status of student at time of exit | | | |
| In good standing | 4 | 14 | 18 |
| Academic drop/suspension | 6 | 2 | 8 |
| Other drop/suspension | -- | -- | -- |
| Unknown | -- | -- | -- |
| c. Ratio of exiting students to enrollment | .07 | .06 | .06 |

B. Student Outcomes Questionnaire Information Summary (150 Respondents), May 1974

| 1. Demographic Characteristics | Number | Percentage |
|---|---|---|
| Men | 130 | 86.7 % |
| Women | 20 | 13.3 |
| Less than 17 years of age | -- | -- |
| 17-19 | -- | -- |
| 19-21 | 4 | 2.7 |
| 21-25 | 102 | 68.0 |
| 25-29 | 24 | 16.0 |
| 29-33 | 14 | 9.3 |
| 33-37 | 6 | 4.0 |
| More than 37 years of age | -- | -- |
| Mean age: 23 years | | |
| American Indian/Alaska Native | -- | -- |
| Asian or Pacific Islander | -- | -- |
| Black/Negro | 10 | 6.7 |
| Hispanic | -- | -- |
| White, Other than Hispanic | 140 | 93.3 |

| 2. Program Completion Information | |
|---|---|
| a. Calendar months to program completion: | |
| Less than 6 months | -- |
| 6-12 | -- |
| 12-18 | 2 |
| 18-24 | 6 |
| 24-30 | 6 |
| 30-36 | 10 |
| 36-42 | 12 |
| 42-48 | 84 |
| 48-54 | 14 |
| 54-60 | 16 |
| More than 60 months | -- |
| Mean: 47 months | |

| 2. Program Completion Information (continued) | Number | Percentage |
|---|---|---|
| b. Number of terms enrolled: | | |
| Full-time only | 114 | 76.0 % |
| Median number of terms: 12 qtrs. | | |
| Part-time only | -- | -- |
| Median number of terms: ------ | | |
| Full-time and part-time | 36 | 24.0 |
| Median number of full-time terms: 9 qtrs. | | |
| Median number of part-time terms: 6 qtrs. | | |
| c. Credits transferred from another institution: | | |
| Yes | 20 | 13.3 |
| No | 130 | 86.7 |
| d. Grade point average: | | |
| Less than 1.50 | -- | -- |
| 1.50-1.99 | -- | -- |
| 2.00-2.49 | 18 | 12.0 |
| 2.50-2.99 | 66 | 44.0 |
| 3.00-3.49 | 42 | 28.0 |
| 3.50-4.00 | 24 | 16.0 |
| Mean: 3.08 | | |
| Median: 2.86 | | |

Table IV.13 (continued)

B. Student Outcomes Questionnaire Information Summary (continued)

| 3. Occupational Plans | Number | Percentage |
|---|---|---|
| a. Current job plans: | | |
| Have job | 90 | 60.0 % |
| Are looking for job | 20 | 13.3 |
| Intend to look in next 6 months | -- | -- |
| Do not intend to look | 40 | 26.7 |
| b. Those who have job regard it as: | | |
| Temporary | 6 | 6.7 |
| A job with possible career potential | 28 | 31.1 |
| A job with definite career potential | 56 | 62.2 |
| Other | -- | -- |
| c. Relation of job held to field of study: | | |
| Not related | 4 | 4.4 |
| Somewhat related | 22 | 24.4 |
| Directly related | 64 | 71.1 |
| d. Annual salary of those with jobs: | | |
| Less than $3,000 | -- | -- |
| $3,000-5,999 | -- | -- |
| $6,000-7,499 | 8 | 8.9 |
| $7,500-8,999 | 22 | 24.4 |
| $9,000-10,499 | 30 | 33.3 |
| $10,500-11,999 | 16 | 17.8 |
| $12,000-13,499 | 8 | 8.9 |
| $13,500-14,999 | 6 | 6.7 |
| $15,000-17,999 | -- | -- |
| $18,000-20,999 | -- | -- |
| $21,000-23,999 | -- | -- |
| $24,000 and over | -- | -- |
| Mean: $9,860 Median: $9,475 | | |

| 4. Educational Plans | Number | Percentage |
|---|---|---|
| a. Current educational plans: | | |
| Have applied to another program | 60 | 40.0 % |
| Intend to apply within a year | 14 | 9.3 |
| Do not intend to apply | 76 | 50.7 |
| b. For those who have applied, the kind of degree or certificate sought: | | |
| Certificate | -- | -- |
| Diploma | -- | -- |
| Associate degree | -- | -- |
| Bachelor's degree | 2 | 3.3 |
| Master's degree | 48 | 80.0 |
| Professional degree | -- | -- |
| Doctor's degree | 10 | 16.7 |
| Other | -- | -- |
| c. Of those who have applied, those: | | |
| Admitted | 42 | 70.0 |
| Not admitted | 2 | 3.3 |
| Awaiting decision | 16 | 26.7 |
| d. Long-term educational plans, highest degree intended: | | |
| Certificate | -- | -- |
| Diploma | -- | -- |
| Associate degree | -- | -- |
| Bachelor's degree | 34 | 22.7 |
| Master's degree | 78 | 52.0 |
| Professional degree | -- | -- |
| Doctor's degree | 38 | 25.3 |
| Other | -- | -- |
| Undecided | -- | -- |

Table IV.13 (continued)

B. Student Outcomes Questionnaire Information Summary (continued)

5. Current and Long-Run Occupational and Educational Program Areas

| Occupational and Educational Program Categories | Area of Current Job | | Intended Long-Run Career | | Area of Next Degree | | Area of Planned Highest Degree | |
|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % |
| 030 Agriculture and Natural Resources | 2 | 2.2 | 6 | 4.0 | | | 4 | 2.7 |
| 060 Architecture and Environmental Design | | | | | | | | |
| 090 Assembly, Installation, Maintenance, Repair | 2 | 2.2 | | | | | | |
| 120 Biological Sciences | | | | | | | | |
| 150 Building and Construction Trades | 2 | 2.2 | | | | | | |
| 180 Business, Management, and Commerce | 60 | 66.7 | 88 | 58.7 | 52 | 86.7 | 110 | 73.3 |
| 210 Communications | 4 | 4.4 | 6 | 4.0 | | | 4 | 2.7 |
| 240 Computer and Information Sciences | 6 | 6.7 | 10 | 6.7 | 2 | 3.3 | 8 | 5.3 |
| 270 Education | 4 | 4.4 | 20 | 13.3 | 2 | 3.3 | 6 | 4.0 |
| 300 Engineering | | | | | | | | |
| 330 Fine, Applied, and Performing Arts | | | | | | | | |
| 360 Foreign Languages | | | | | | | | |
| 390 Health Services | | | | | | | | |
| 420 Home Economics and Homemaking | | | | | | | | |
| 450 Interdisciplinary Studies | | | | | | | | |
| 480 Law | 2 | 2.2 | 6 | 4.0 | | | 6 | 4.0 |
| 510 Letters | | | | | | | | |
| 540 Library Science | | | | | | | | |
| 570 Machine Trades | | | | | | | | |
| 600 Mathematics and Statistics | | | | | | | | |
| 630 Military Sciences | | | | | | | | |
| 660 Personal Services | | | | | | | | |
| 690 Physical Sciences | | | | | | | | |
| 720 Psychology | | | | | | | | |
| 750 Public Affairs and Services | 8 | 8.9 | 14 | 9.3 | 4 | 6.7 | 12 | 8.0 |
| 780 Social Sciences | | | | | | | | |
| 810 Theology | | | | | | | | |
| 998 Undecided | | | | | | | | |
| 999 Other | | | | | | | | |
| TOTAL | 90 | 100.0* | 150 | 100.0* | 60 | 100.0* | 150 | 100.0* |

* Detail may not add due to rounding.

Table IV.13 (continued)

B. Student Outcomes Questionnaire Information Summary (continued)

6. Student Perceptions of Growth

| | Intellectual | | Social | | Aesthetic/ Cultural | | Educational | | Vocational-Professional | | Personal | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Institution's Contribution To Progress | N | % | N | % | N | % | N | % | N | % | N | % |
| (1) None | -- | -- | -- | -- | 8 | 5.3 | -- | -- | -- | -- | -- | -- |
| (2) Little | 18 | 12.0 | 26 | 17.3 | 32 | 21.3 | 8 | 5.3 | 4 | 2.7 | 22 | 14.7 |
| (3) Moderate | 42 | 28.0 | 84 | 56.0 | 64 | 42.7 | 38 | 25.3 | 24 | 16.0 | 66 | 44.0 |
| (4) Much | 64 | 42.7 | 24 | 16.0 | 26 | 17.3 | 80 | 53.3 | 72 | 48.0 | 46 | 30.7 |
| (5) Very Much | 26 | 17.3 | 16 | 10.7 | 20 | 13.3 | 24 | 16.0 | 50 | 33.3 | 16 | 10.7 |
| Mean* | 3.65 | | 3.20 | | 3.12 | | 3.80 | | 4.12 | | 3.37 | |
| Importance of That Progress | | | | | | | | | | | | |
| (1) None | 6 | 4.0 | -- | -- | 18 | 12.0 | -- | -- | -- | -- | -- | -- |
| (2) Little | 26 | 17.3 | 28 | 18.7 | 34 | 22.7 | -- | -- | -- | -- | 16 | 10.7 |
| (3) Moderate | 58 | 38.7 | 82 | 54.7 | 68 | 45.3 | 36 | 24.0 | 22 | 14.7 | 64 | 42.7 |
| (4) Much | 38 | 25.3 | 28 | 18.7 | 22 | 14.7 | 82 | 54.7 | 62 | 41.3 | 54 | 36.0 |
| (5) Very Much | 22 | 14.7 | 12 | 8.0 | 8 | 5.3 | 32 | 21.3 | 66 | 44.0 | 16 | 10.7 |
| Mean* | 3.29 | | 3.16 | | 2.79 | | 3.97 | | 4.29 | | 3.47 | |

*The mean for each area is based on the value indicated in parentheses for each response.

3. Tables IV.10 and 12 bring together student program activity and cost measures that, for the most part, have been referenced elsewhere. Total SCH (line 1), total direct costs (line 5), and total full costs (line 9), are from the program unit cost reports of DMM. FTE students (line 2) may be calculated directly from the SCH in line 1, using the institution's definition of FTE (see the footnote to Tables IV.10 and 12).

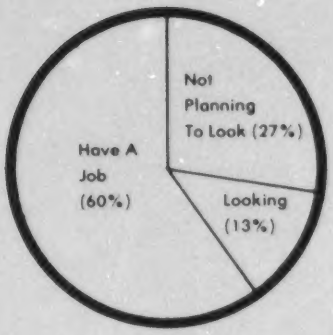
   If the institution has completed the program enrollments report of DMM, the FTE figure may be found there also, along with the data for headcount enrollments (line 3). If the DMM program enrollments report has not been used, the headcount enrollment figures may be taken from Format F.1 of the IEP data formats instead.

   Once the credit hour, FTE student, and headcount student information has been obtained, the unit costs in lines 6, 7, 8, 10, 11, and 12 may be calculated for each student level and for the program as a whole. The measures in lines 4 and 13 have been added since they may be of use in the description and analysis of costs within and across student programs.

4. Table IV.13 is a summary of all IEP student outcomes information for the program. Section A of the table contains information from institutional records on enrollments, program completions,

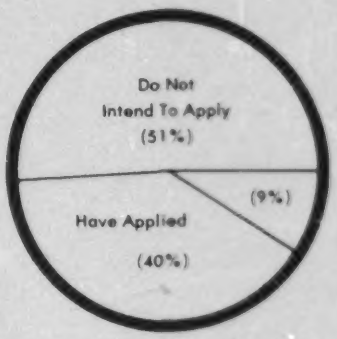
## Figure IV. 1

### SAMPLE GRAPHIC DISPLAYS OF OUTCOMES DATA

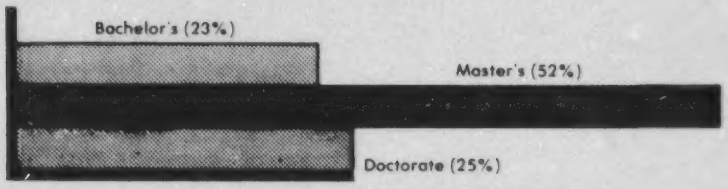



B.3.a Current Job Plans

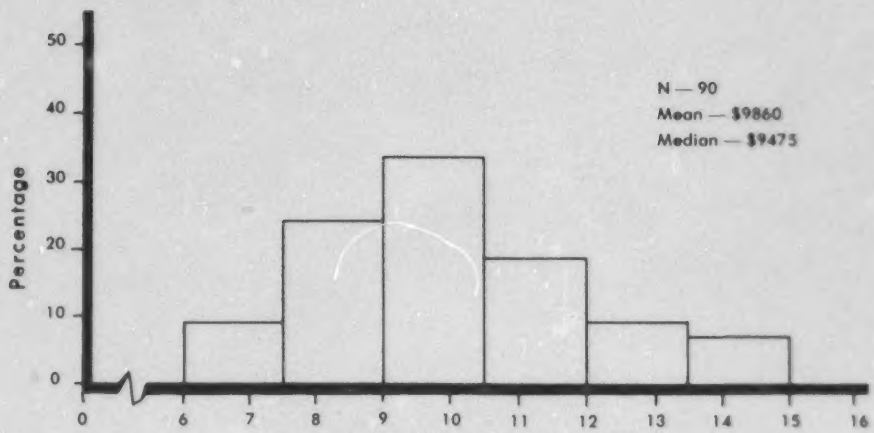
N — 150




B.4.a Current Educational Plans




B.4.d Highest Degree Planned




B.3.d Annual Salary Of Those With Jobs ($ Thousands)

and exiting students. This is the same information as that shown in Format F.1 of the IEP data formats, except for the ratios in items 2.b and 3.c, which have been calculated specifically for these profiles.

The remainder of Table IV.13 is a summary of information provided by the student on the NCHEMS Student Outcomes Questionnaire for Program Completers.* This questionnaire data summary is taken directly from the printed reports of the Student Outcomes Module. In the present example, this information has been summarized for a particular student program and degree type. It should be noted, however, that other aggregation options are open to the institution in using SOM; for example, summaries may be prepared by HEGIS codes, by institutional major codes, by student level, and for the institution as a whole.

In preparing the student outcomes portion of the student program profile, the institutional analyst should consider the use of graphic presentations of some of the data. Such displays, examples of which are shown in Figure IV.1, often communicate relevant information more effectively and more quickly than columns of numbers and do so without the loss of important data.

*A summary of questionnaire items is included in the appendix.

Comments: 1. The reader may have noted that the total direct cost figures shown in Tables IV.1 and IV.8 are not identical. This is explained by the fact that some of the student credit hours generated by the disciplines were "consumed" by part-time nondegree students. Those credit hours are reflected in Table IV.1, but not in IV.8.

2. As was the case with the departmental profiles, only three of the four dimensions of the Student Data Module reports have been used in the examples given here--course level is not shown for each of the disciplines "consumed" by the student program. (To illustrate, in Table IV.9, Column A shows lower division mathematics students consuming 12 SCH in aerospace science but it does not specify how many of those SCH are in lower division courses and how many in upper division.)

   An additional simplification is noted in the footnote on part one of each profile: a single unit cost figure has been used for each of the disciplines "consumed." In actuality, if the program's students consumed credit hours at different course levels within a discipline, the appropriate unit cost would be used for each course level in calculating program costs. (In practice, this is accomplished in the Data Management Module.)

3. The difficulty of arriving at the real costs to the institution for a student program should be clearly recognized. The cost

figures shown in parts one and two of each profile are only those costs that derive from the instructional disciplines and that are distributed to student programs according to student credit hours consumed. But a student program imposes many costs on the institution that do not derive from costs in the instructional disciplines and that may not be related to credit hour consumption. Useful examples may be cited in many areas of academic support, institutional support, and student service, in which the student who carries six credits may well impose as much of a load on the support functions as one who carries 15 credits. The point to be made is simply that the cost figures presented in these profiles must be interpreted and used with due caution.

4. Another caution must be exercised with respect to the student outcomes information, particularly in those programs with small numbers of students and program completers. It is recommended that whenever percentages are shown for a measure, the number of individuals represented should be shown also. Problems arising in statistical analysis when small numbers are involved are discussed in more detail in the sections dealing with analytical studies. Even in the descriptive displays given in this section, however, means, medians, and percentages should not be used without an accompanying indication of the absolute numbers involved.

5. The examples given here are all for individual student programs--that is, a single major and a single degree type. Some questions of interest to the institution may best be addressed by examining aggregations of student program information, by major or degree type or both. One such example might involve comparisons of lower division and upper division credit hour consumption between humanities and social science undergraduates. Another might consider job placement rates or student perceptions of growth for bachelor's versus master's degree recipients. The institution is encouraged to exercise such options through the flexibility of the NCHEMS Costing and Data Management System software.

## Planning and Management Applications

The profiles in this section are intended to be useful in describing the institution's student degree programs. They should enable the user to look behind certain assumptions about the curriculum, for example, to discover what pattern of courses actually constitutes the instructional experience of the program's students. Such a discovery may have important implications for curriculum development and for decisions concerning program additions and deletions.

Other planning and management activities are assisted by these profiles, as illustrated by the following brief examples:

- Program assessment. Is the program achieving what the institution expects of it? What activities do students pursue when they leave

the program? What are their long-term plans? How well do these results match with the program's objectives?

- Course demand. What can be learned from current consumption patterns to prepare for the future? What changes in course patterns take place in the transition from lower to upper division? If a program is expanding (or contracting), what are the course load implications for the disciplines?
- Program curriculum comparisons. How alike or different are the institution's student programs in terms of curricular composition? What are the implications concerning the variety of learning opportunities for students? What are the effects on the ease with which students may transfer from one program to another?
- Program outcome comparisons. How alike or different are programs in terms of student outcome measures? Do programs that might be expected to exhibit similar student outcomes in fact do so? Are there differences in student "success" measures from one student level to another in the program--say, between bachelor's and master's degree recipients?
- Program comparisons over time. What kinds of change do programs exhibit over time in terms of size, course consumption patterns, completion rates, and student outcome measures? What are the implications of these changes for program planning? Are new programs, in effect, being created? Should some programs be phased out? Should some be combined? What effects may be projected for the departments?

Ultimately, the institutional decision maker will want to know why these differences exist, why these changes are occurring, and how to cope with them. Sections V through VII of this document are intended to assist in examining those matters in more detail. To a large degree, however, the answers to those questions will be the result of particular institutional situations or will depend on information from outside the institution (such as job market data) that is not a part of the IEP data base.

Nonetheless, these profiles constructed from IEP data, and institutional variations of them, can provide important information about the institution's activities from a somewhat different perspective than that often held by the manager of a department or division. They may thus result in a more active concern for the management of student programs on the part of institutional decision makers.

# V

# ANALYTICAL STUDIES OF COST DATA

The analytical studies sections of this manual are intended to provide procedures and techniques for isolating, examining, and explaining differences among institutional components in costs and in outcomes. Because the instructional department (or discipline) and student program components are of primary interest for planning and management purposes, these two institutional components will be emphasized throughout the procedures and examples given in this section.

The principal difference between these sections and the preceding profile and narrative sections is in the emphasis that will be placed on explaining rather than simply describing departmental or program differences in costs or outcomes; that is, the analytical studies sections will provide procedures for investigating such questions as:

- Why does department X have costs that are twice as high as a similar department's costs?
- What factors account for the relatively low costs for students in degree program Y?
- Why are 80 percent of students in program X able to obtain jobs after graduation while only 40 percent of students in program Y are able to do so?
- What student characteristics help to explain why the average student in program X takes five years to complete a degree?

There is another difference between these sections and previous ones: that is the attempt to build new variables or indices from several existing pieces of data. For example, in the procedures for analytical studies of costs, three methods are shown for aggregating existing information into a "cost per degree" estimate. Thus, where appropriate, procedures will be developed for rearranging or aggregating data into new, more useful variables or constructs.

## General Purpose and Uses of Analytical Studies

The general purpose underlying any analytical study in this manual is the improvement of planning and management by the provision of accurate, up-to-date information on which to base decisions. More specifically, however, the objective of performing in-depth analytical studies is to provide tools for going beyond the profiling or descriptive stage toward an understanding of the causes or reasons underlying differences in student programs, departments, or other institutional components of interest. A step has been made toward understanding costs, for example, when one compares departmental profiles and notices that the physics department costs twice as much to operate per credit hour produced as the math department. An even greater step has been made toward knowing the possible planning consequences of this knowledge when further analysis reveals that the physics department spends a substantial amount on supplies and services and that 80 percent of the faculty are of full professor rank, while the math department spends very little on supplies and services and only 25 percent of the faculty are of full professor rank. Similarly, in studying outcome variables one might observe

that business majors average five years to complete an undergraduate degree, while most other majors finish in approximately four years. Further analysis of the data might show that a large percentage of business majors are part-time students, which increases understanding of the problem, and may lead to improved planning and management decisions.

Thus the purpose of the procedures and analytical techniques described in the following sections is to facilitate sound decision making in postsecondary education by describing tools and furnishing examples that can be used to answer the question of why student program and departmental differences exist in costs and in outcomes. The general approach will be to:

- Examine descriptive summaries of the data across departments or student programs. (This step relies on descriptive information and techniques such as those found in the profiles in Section IV of this manual.)
- Provide methods of isolating large or significant differences among student programs or departments.
- Provide techniques for following-up departmental or program differences to attempt to explain the underlying causes.
- Discuss potential uses of the results of each analysis.

In this first section, describing methods for analyzing cost data, three types of cost studies* are presented:

*In the department cost study, direct costs are the primary focus, while full costs are used in all examples in the other two studies. Direct costs generally are more appropriate when the intent is to examine cost factors directly under the control of the department manager. Full costs are more appropriate for pricing (such as tuition rate-setting) or other resource aquisition questions.

1. The first study focuses on methods of identifying significant differences and underlying explanatory factors in costs across departments (or disciplines).
2. The second study emphasizes identifying and explaining student program cost differences.
3. In the third cost analysis study, three methods are described for computing costs per graduate and procedures are suggested for identifying and explaining cost per graduate differences among student programs.

It should be noted that while the areas of emphasis for cost studies suggested in this manual are fairly specific (for example, examining direct costs across departments), many of the procedures suggested are very general. Thus, with minor modifications, most of the procedures suggested below can be tailored to fit other cost analysis questions concerning, for example, full costs across departments or direct costs across programs or other institutional components of interest.

## A. Studies of Cost Differences Among Departments (or Disciplines)

The first two steps in exploring and understanding departmental cost differences are (a) examining ("getting a feeling for") the data and (b) identifying departments that are significantly different from some norm. (The norm can be a prior expectation or a statistical value such as the mean or median across departments.) These two steps are combined in the procedure described below, since the process of looking for differences among departments tends to familiarize the analyst with the data.

Procedure: Isolating significant departmental cost differences.

1. There are a number of direct cost-related variables associated with each discipline and course level that might be used to investigate departmental direct cost differences. These variables inc'ude:
   - Total student credit hours produced (SCH)
   - Total direct cost
   - Direct unit cost
   - Faculty compensation per full-time equivalent (FTE) faculty member
   - Student credit hours produced per faculty FTE.

2. The suggested approach for dealing with these variables is to rank departments within course level (lower, upper, or graduate) on the basis of direct unit cost and at the same time, display

Table V.1

CREDIT HOURS, TOTAL DIRECT COST, AND DIRECT UNIT COST BY DEPARTMENT
Community College Data, 1973-74
(Ranked by Direct Unit Cost)

| Rank | Department Name | Credit Hours | Total Direct Cost | Direct Unit Cost |
|---|---|---|---|---|
| 1 | Education--Other | 1,180 | $ 9,310 | $ 7.89 |
| 2 | Archaeology | 126 | 1,078 | 8.55 |
| 3 | Public Adm/Mgmt. | 2,138 | 19,510 | 9.13 |
| 4 | Public Services | 106 | 1,086 | 10.25 |
| 5 | Oceanography | 1,786 | 19,364 | 10.84 |
| 6 | Banking & Finance | 3,648 | 43,981 | 12.06 |
| 7 | Fire Control | 870 | 11,336 | 13.03 |
| 8 | Art History | 2,035 | 28,676 | 14.09 |
| 9 | Criminology | 643 | 9,164 | 14.25 |
| 10 | Geography | 1,403 | 20,347 | 14.50 |
| 11 | Elementary Education | 14,210 | 215,015 | 15.13 |
| 12 | Chinese | 226 | 3,745 | 16.57 |
| 13 | English | 2,142 | 37,378 | 17.44 |
| 14 | Psychology | 7,081 | 123,637 | 17.46 |
| 15 | Law Enforcement | 1,132 | 20,812 | 18.39 |
| 16 | Home Economics | 10,584 | 199,858 | 18.88 |
| 17 | Community Service | 2,918 | 55,415 | 18.99 |
| 18 | Inhalation Ther. | 870 | 17,558 | 20.18 |
| 19 | Economics | 2,898 | 61,700 | 21.29 |
| 20 | Urban Studies | 336 | 7,291 | 21.70 |
| 21 | History | 6,162 | 136,387 | 22.13 |
| 22 | Medical Asst. | 2,457 | 54,552 | 22.20 |
| 23 | Surgical | 855 | 19,077 | 22.31 |
| 24 | Accounting | 5,983 | 135,401 | 22.63 |
| 25 | Business Statistics | 570 | 13,687 | 24.01 |
| 26 | Spanish | 1,206 | 31,117 | 25.80 |
| 27 | Cinematography | 386 | 10,594 | 27.45 |
| 28 | Comp. Operator | 484 | 13,681 | 28.27 |
| 29 | Secretarial | 11,273 | 323,481 | 28.70 |
| 30 | Diesel | 3,888 | 121,147 | 31.16 |
| 31 | Const. Buildings | 8,558 | 266,866 | 31.18 |
| 32 | Comp. Programmer | 5,238 | 167,196 | 31.92 |
| 33 | Automotive | 9,747 | 315,194 | 32.44 |
| 34 | Nursing, Pract. | 6,407 | 207,935 | 32.45 |
| 35 | Welding | 5,224 | 180,497 | 34.55 |
| 36 | Dental Asst. | 1,534 | 58,798 | 38.33 |
| 37 | Photography | 1,415 | 56,091 | 39.64 |
| 38 | Agriculture | 1,080 | 57,202 | 52.96 |
| 39 | Hotel - Rest. | 1,207 | 73,805 | 61.15 |
| 40 | Math/Science | 119 | 10,226 | 85.93 |
| 41 | Engineering | 205 | 18,375 | 89.63 |
| 42 | Team Sports | 96 | 12,486 | 130.06 |
| 43 | Org. Chemistry | 66 | 10,557 | 159.95 |
| 44 | Physical Science | 56 | 11,084 | 197.93 |

the values of all (or some) of the other variables for each department. (Data management computer programs can be used to produce the tables shown below, or the tables can be done by hand.) This procedure results in a display similar to those shown in Tables V.1 and V.2. (Note that at least two other variables, faculty compensation/FTE and SCH/Faculty FTE, could have been included as columns in the table at the option of the analyst.) This simple ranking may be of interest in itself. For example, clustering of certain departments among high (or low) ranks may be revealing. Comparing actual rankings with the prevailing "conventional wisdom" also may be instructive. Exceptionally high or low cost departments usually can be identified from inspection of these tables.

3. Convert the unit cost information to graphic form, using the ranks obtained in the previous step to sequence data points. Plot the unit cost values on the vertical axis and departments on the horizontal axis. Place the department with a rank of 1 closest to the vertical axis, the department with a rank of 2 next closest, and so forth. This will facilitate visual identification of patterns or clusters. The resulting diagram should be of the form shown in Figure V.1a for the community college data in Table V.1. One point of interest here concerns the possible existence of any breaks in the cost trend. In other words, do clusters emerge such that the cluster members

Table V.2a

CREDIT HOURS, TOTAL DIRECT COST, AND DIRECT UNIT COST
Lower Division Departments in a Large Research University, 1973-74
(Ranked by Direct Unit Cost)

| Rank | Department Name | Credit Hours | Total Direct Cost | Direct Unit Cost |
|---|---|---|---|---|
| 1 | Anthropology | 3,246 | $ 10,724 | $ 3.30 |
| 2 | Musicology | 1,029 | 4,981 | 4.84 |
| 3 | Naval Science | 574 | 5,568 | 9.70 |
| 4 | Sociology | 6,906 | 68,983 | 9.99 |
| 5 | Psychology | 12,879 | 165,854 | 12.88 |
| 6 | Atmospheric Science | 421 | 6,711 | 15.94 |
| 7 | Computer Science | 7,323 | 126,313 | 17.25 |
| 8 | Economics | 16,908 | 303,661 | 17.96 |
| 9 | Political Science | 4,149 | 88,320 | 21.29 |
| 10 | Statistics | 2,943 | 70,599 | 23.99 |
| 11 | Biological Science | 32,780 | 788,649 | 24.06 |
| 12 | Construction Tec. | 1,405 | 36,942 | 26.29 |
| 13 | Military Science | 166 | 4,700 | 28.31 |
| 14 | Education | 3,174 | 93,886 | 29.58 |
| 15 | Physics | 18,984 | 594,316 | 31.31 |
| 16 | Chemistry | 39,442 | 1,288,638 | 32.67 |
| 17 | Theatre | 1,725 | 60,766 | 35.23 |
| 18 | English | 27,135 | 970,988 | 35.78 |
| 19 | Agronomy | 2,699 | 99,446 | 36.85 |
| 20 | French | 6,440 | 238,162 | 36.98 |
| 21 | Med. Chemistry | 1,240 | 47,842 | 38.58 |
| 22 | Biochemistry | 1,790 | 69,942 | 39.07 |
| 23 | Philosophy | 4,344 | 179,056 | 41.22 |
| 24 | Aero, Astro, Eng. S. | 2,968 | 130,013 | 43.80 |
| 25 | Physical Education | 6,779 | 304,060 | 44.85 |
| 26 | Mechanical Tech. | 2,974 | 138,717 | 46.64 |
| 27 | Audio & Spch. Sci. | 1,297 | 67,202 | 51.81 |
| 28 | Electrical Tech. | 2,948 | 167,829 | 56.93 |
| 29 | Nursing | 5,204 | 336,107 | 64.59 |
| 30 | Civil Engineering | 6,202 | 427,752 | 68.97 |
| 31 | Mechanical Engr. | 3,785 | 272,499 | 71.99 |
| 32 | Russian | 851 | 62,463 | 73.40 |
| 33 | Modern Languages | 114 | 10,298 | 90.33 |
| 34 | Aviation Tech. | 4,049 | 371,703 | 91.80 |
| 35 | General Agricul. | 973 | 102,930 | 105.79 |
| 36 | Mat. Sci. & Mtl. En. | 162 | 17,346 | 107.07 |
| 37 | Entomology | 387 | 47,368 | 122.40 |
| 38 | Nuclear Engr. | 289 | 36,636 | 126.77 |
| 39 | Industrial Education | 770 | 99,564 | 129.30 |
| 40 | Industrial Engr. | 980 | 139,588 | 142.44 |

Table V.2b

CREDIT HOURS, TOTAL DIRECT COST, AND DIRECT UNIT COST
Upper Division Departments in a Large Research University, 1973-74
(Ranked by Direct Unit Cost)

| Rank | Department Name | Credit Hours | Total Direct Cost | Direct Unit Cost |
|---|---|---|---|---|
| 1 | Naval Science | 354 | $ 3,698 | $ 10.45 |
| 2 | Anthropology | 2,421 | 33,704 | 13.92 |
| 3 | Pharmacol. & Toxicology | 621 | 10,015 | 16.13 |
| 4 | Aero Sci.--Air Force | 579 | 10,177 | 17.58 |
| 5 | Child Dev., Family Living | 4,193 | 79,632 | 18.99 |
| 6 | Psychology | 9,323 | 190,923 | 20.48 |
| 7 | Industrial Mgt. | 20,376 | 443,470 | 21.76 |
| 8 | Agric. Economics | 4,023 | 103,473 | 25.72 |
| 9 | Sociology | 7,794 | 244,455 | 31.36 |
| 10 | Creative Arts | 5,492 | 178,952 | 32.58 |
| 11 | Agronomy | 3,026 | 101,625 | 33.58 |
| 12 | Clothing & Text | 1,353 | 50,167 | 37.08 |
| 13 | Economics | 3,009 | 116,984 | 38.88 |
| 14 | Equipment & Fam. Hous. | 1,443 | 56,897 | 39.43 |
| 15 | Botany & Plant Path. | 971 | 40,641 | 41.85 |
| 16 | Military Band | 596 | 26,418 | 44.33 |
| 17 | Institutional Mgt. | 1,845 | 83,071 | 45.02 |
| 18 | General Home Economics | 434 | 19,990 | 46.06 |
| 19 | Supervision | 1,657 | 78,300 | 47.25 |
| 20 | Bionucleonics | 468 | 24,064 | 51.42 |
| 21 | Forestry | 1,937 | 102,250 | 52.79 |
| 22 | Industrial Engr. | 4,724 | 271,005 | 57.37 |
| 23 | French | 692 | 40,420 | 58.41 |
| 24 | Biological Science | 1,949 | 115,349 | 59.18 |
| 25 | Agric. Engineering | 1,435 | 90,342 | 62.96 |
| 26 | Animal Science | 3,177 | 204,441 | 64.35 |
| 27 | Mechanical Tech. | 1,250 | 80,945 | 64.76 |
| 28 | Horticulture | 1,977 | 130,316 | 65.92 |
| 29 | Physics | 4,951 | 352,907 | 71.28 |
| 30 | Mechanical Engr. | 9,226 | 702,435 | 76.14 |
| 31 | Chemical Engr. | 2,709 | 212,776 | 78.54 |
| 32 | Nursing | 720 | 58,669 | 81.48 |
| 33 | Aero, Astro, Eng. S. | 2,627 | 247,034 | 94.04 |
| 34 | Russian | 92 | 8,916 | 96.91 |
| 35 | Aviation Tech. | 1,081 | 111,459 | 103.11 |
| 36 | Industrial Education | 891 | 98,766 | 110.85 |
| 37 | Biochemistry | 44 | 5,412 | 123.00 |
| 38 | Mat. Sci. & Mtl. En. | 758 | 110,183 | 145.36 |
| 39 | Geoscience | 1,009 | 149,562 | 148.23 |
| 40 | General Studies | 236 | 35,621 | 150.94 |
| 41 | Nuclear Engr. | 138 | 41,687 | 302.08 |

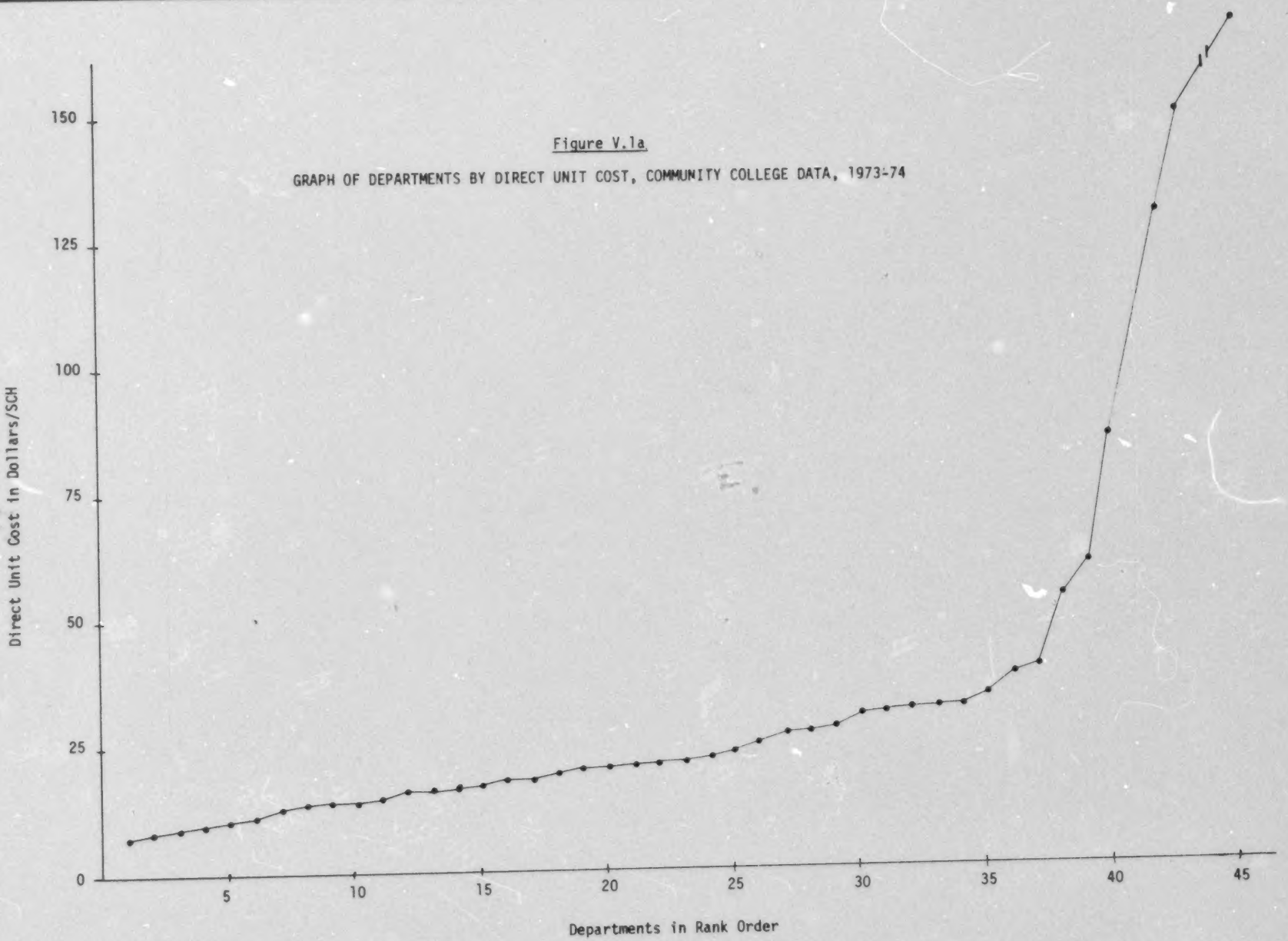
Table V.2c

CREDIT HOURS, TOTAL DIRECT COST, AND DIRECT UNIT COST
Graduate Division Departments in a Large Research University, 1973-74
(Ranked by Direct Unit Cost)

| Rank | Department Name | Credit Hours | Total Direct Cost | Unit Cost |
|---|---|---|---|---|
| 1 | Italian | 3 | $ 177 | $ 59.00 |
| 2 | Biochemistry | 4,086 | 273,460 | 66.93 |
| 3 | Forestry | 2,827 | 190,767 | 67.48 |
| 4 | Anthropology | 970 | 67,849 | 69.95 |
| 5 | Clothing & Text. | 852 | 61,048 | 71.65 |
| 6 | Supervision | 258 | 19,052 | 73.84 |
| 7 | Industrial Mgt. | 8,774 | 684,979 | 78.07 |
| 8 | Computer Science | 4,466 | 355,340 | 79.57 |
| 9 | Child Dev., Family Living | 2,739 | 265,194 | 96.82 |
| 10 | Statistics | 4,621 | 476,717 | 103.16 |
| 11 | Animal Science | 3,120 | 340,603 | 109.16 |
| 12 | Pharmacol. & Toxicology | 2,265 | 247,800 | 109.40 |
| 13 | Russian | 276 | 30,515 | 110.56 |
| 14 | Agric. Economics | 2,661 | 303,790 | 114.16 |
| 15 | Communication | 2,462 | 281,264 | 114.24 |
| 16 | Psychology | 10,960 | 1,252,571 | 114.29 |
| 17 | Atmospheric Sci. | 389 | 45,599 | 117.22 |
| 18 | Economics | 2,615 | 306,923 | 117.37 |
| 19 | Political Sci. | 3,152 | 375,901 | 119.26 |
| 20 | Creative Arts | 1,105 | 133,119 | 120.47 |
| 21 | Botany & Plant Path. | 1,101 | 134,777 | 122.41 |
| 22 | Education | 12,690 | 1,592,168 | 125.47 |
| 23 | Graduate Thesis | 589 | 79,456 | 134.90 |
| 24 | Mechanical Engr. | 5,798 | 833,313 | 143.72 |
| 25 | German | 641 | 93,692 | 146.17 |
| 26 | Audio & Spch. Sci. | 3,466 | 517,076 | 149.19 |
| 27 | Physical Education | 1,381 | 211,103 | 152.86 |
| 28 | Chemistry | 8,858 | 1,383,421 | 156.17 |
| 29 | Electrical Engr. | 4,820 | 755,627 | 156.77 |
| 30 | Biological Science | 10,317 | 1,740,881 | 168.74 |
| 31 | Entomology | 885 | 158,189 | 178.74 |
| 32 | Aero, Astro, Eng. S. | 2,622 | 490,902 | 187.22 |
| 33 | Pharmacy | 1,724 | 341,586 | 198.14 |
| 34 | Home Mgt. & Fam. Ec. | 288 | 57,558 | 199.85 |
| 35 | Equipment & Fam. Hous. | 174 | 40,812 | 234.55 |
| 36 | Nuclear Engr. | 1,061 | 270,736 | 255.17 |
| 37 | Geoscience | 836 | 223,788 | 267.69 |
| 38 | Med. Chemistry | 595 | 194,686 | 327.20 |
| 39 | Veterinary Med. | 1,539 | 509,534 | 331.08 |
| 40 | Physics | 4,390 | 1,572,023 | 358.09 |

Figure V.1a

GRAPH OF DEPARTMENTS BY DIRECT UNIT COST, COMMUNITY COLLEGE DATA, 1973-74



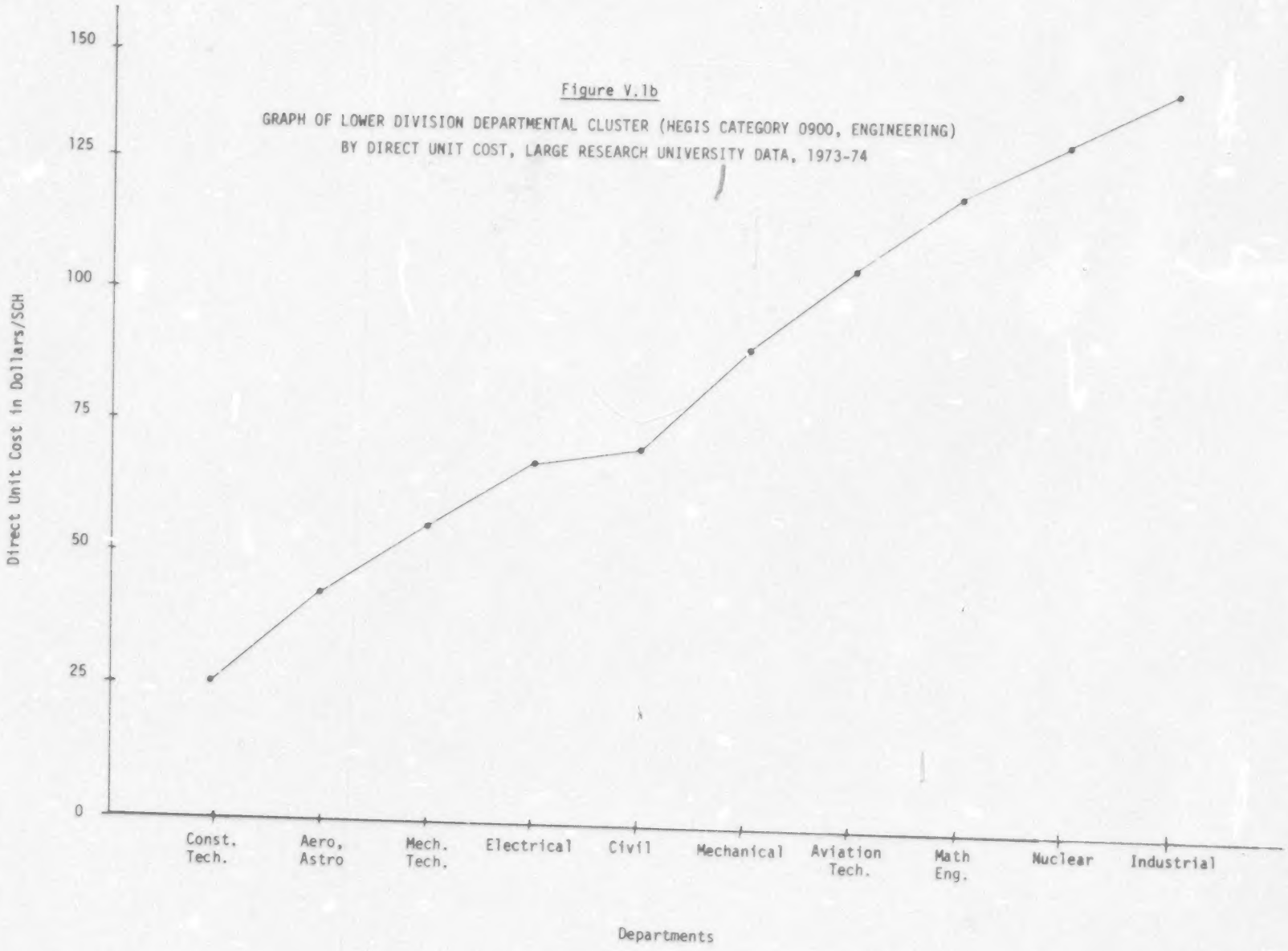
have costs markedly closer to one another than to any departments outside the cluster? If there are clusters, are they natural groups in the sense that their existence could have been predicted a priori on the basis of departmental content, experience, and so forth?

4. In determining significant cost differences among departments (within course level), there are no hard and fast rules that apply to all institutions. There are, however, some factors that should be considered in deciding what constitutes a significant difference, and from these factors each institutional analyst must decide what magnitude of departmental direct unit cost differences will be considered significant and worth pursuing further. Some factors to consider are:

   - Distribution of costs. Are there abrupt breaks in the graph from one set of unit costs to a higher set of costs? Are there exceptionally high or low values?
   - Department clusters in costs. Do similar departments cluster together? Do the department clusters conform to prior expectations?
   - Percentage increases in costs. Do some departments cost twice or three times what others cost?
   - Student credit hour production. Are the high-cost departments producing few student credit hours? How are the high student credit hour departments distributed?

Figure V.1b

GRAPH OF LOWER DIVISION DEPARTMENTAL CLUSTER (HEGIS CATEGORY 0900, ENGINEERING)
BY DIRECT UNIT COST, LARGE RESEARCH UNIVERSITY DATA, 1973-74



Comments: 1. Another way of graphing direct unit costs that can be useful is to group similar departments together on the horizontal axis rather than plot departments in rank order of direct unit cost. The resulting graph will highlight departments that have direct unit costs that are quite different within a cluster of similar departments, and, therefore, indicate areas where further investigation of cost differences is warranted. Figure V.1b illustrates such a graph for one discipline group in the lower division Large Research University data.

2. This procedure has been defined in terms of individual departments and course levels. For certain purposes, it may be useful to apply the procedure to the average unit costs for various aggregations of departments or to departments without regard to course levels. This may be especially appropriate when dealing with large numbers of departments or departments of unusually small size.

3. The procedure has been defined in terms of a set of unit costs derived for a single time period. If multi-period data are available, the procedure could be applied equally validly to assess the significance of differences in unit costs over time. It is probably more appropriate, however, to use procedures specifically tailored to time sequence data (see Section VII).

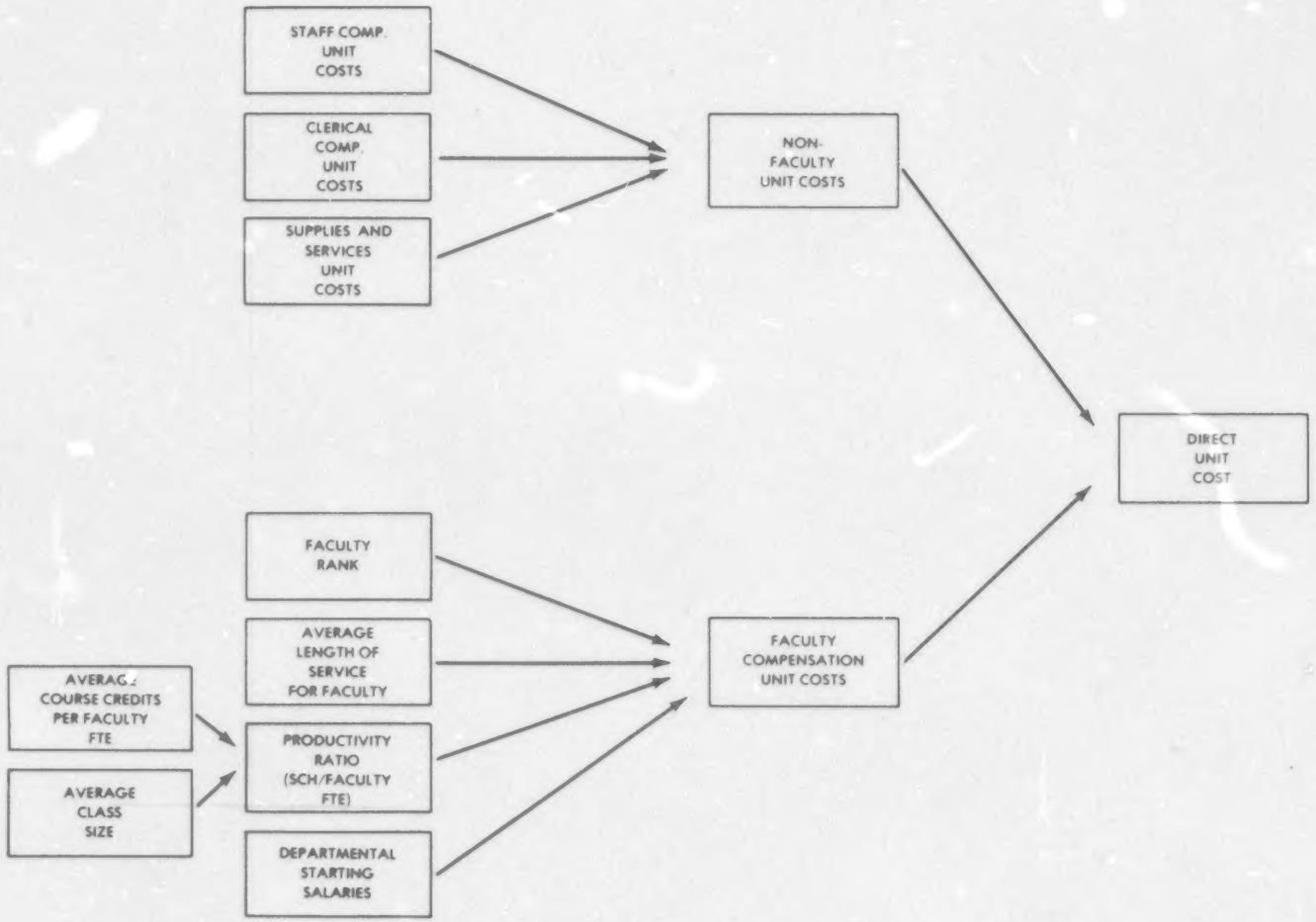
4. Frequently, the most important aspect of the ranked tables is the isolation of the most extreme departments for further analysis and explanation. The high cost or low cost departments can be found by looking at the graph (in Step 3) or by simply examining the tables constructed from Step 2. Generally, there will be a group of departments that are not just higher than all other departments, but are abruptly higher. The Community College data illustrate this point in that most (80 percent) of the departments cost from $8 to $40 per unit, while 20 percent of the departments cost from $40 to $200 per unit. In fact, the last few ranked departments are exceptionally high in relation to all other departments. These high cost departments should be flagged for further analysis, outlined in the next procedure--understanding and explaining costs.

Procedure: Explaining departmental cost differences.

The previous procedure outlined methods for isolating departmental costs that bear further investigation. This procedure describes methods and variables that will be helpful in explaining why certain departments cost much more (or much less) than others. The analyst must keep in mind, however, that the process described here is essentially one of detection or sleuthing. Just as the detective cannot solve mysteries by simply following steps from a book, neither can the cost analyst explain costs without using intuition and experience with the institution in combination with suggestions given in this procedure.

Figure V. 2

**COMPONENTS AND EXPLANATORY FACTORS FOR DIRECT UNIT COSTS WITHIN DEPARTMENTS**



A set of potentially useful explanatory variables by department (or discipline) within course level includes:

- Faculty compensation unit costs per SCH produced
  - Percentage of faculty in each rank
  - Average length of service of faculty
  - Starting salary structure
  - Productivity ratio (SCH divided by faculty FTE)
    - Average course credits taught per faculty FTE
    - Average class size
- Nonfaculty unit costs (all direct unit costs except faculty compensation unit costs)
  - Administrative compensation per SCH
  - Clerical (other) compensation per SCH
  - Supplies, services, and equipment costs per SCH

The chain of reasoning that interrelates these variables is as follows (see Figure V.2):

- Direct cost is made up of two major components: (1) faculty compensation and (2) all other costs (supplies and services, administrative compensation, and clerical and other compensation). Both of these components can be converted to unit costs by dividing by credit hours produced.
- Therefore, a department that has high direct unit costs has: (1) high faculty compensation per credit hour produced, or (2) high "other" unit costs, or (3) both.

- If high salaries per credit hour produced are the cause of high direct unit costs, there are several possible explanations: (1) faculty salary structures (within ranks) are different across departments, (2) high cost departments have a large proportion of faculty at the full and associate professor ranks, (3) faculty members in the high cost departments are producing fewer credit hours, and (4) certain departments have faculty who have been employed longer by the institutions.
- If a low productivity ratio appears to explain direct unit cost differences between two or more departments, a further breakdown of productivity ratio is possible. Average course credits per faculty FTE and average class size are the two components of the productivity ratio, although these are not computed directly as a part of IEP.
- If faculty compensation per credit hour appears similar among departments, then differences in nonfaculty unit costs must account for any direct unit cost differences. These "other" unit costs can be investigated further by breaking them into three components: (1) administrative (staff) compensation per SCH, (2) clerical and other compensation per SCH, and (3) supplies and services costs per SCH.

Clearly this model will not lead directly to answers to such questions as why certain departments have larger proportions of full professors than others or why administrative compensation unit cost is different from one department to the next. The model will, however, help to explain costs to the level of detail shown in Figure V.2 and will, therefore, lead to a better understanding of departmental cost differences.

## Table V.3

COMPONENTS AND EXPLANATORY FACTORS OF DIRECT UNIT COSTS
Lower Division Departments in a Large Research University, 1973-74
(Ranked by Direct Unit Cost)

| Department Name | Direct Unit Cost | Major Components of Direct Unit Cost | | Explanatory Factors of Faculty Compensation Unit Cost | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Nonfaculty Unit Cost | Faculty Unit Cost | SCH / FTE | % Full Professor | % Assoc. Professor | % Ass't Professor | % Other Ranks |
| Anthropology | $ 3.30 | $ .80 | $ 2.50 | 3,538 | 32 | 21 | 38 | 15 |
| Musicology | 4.84 | 1.26 | 3.58 | 3,921 | 21 | 8 | 43 | 28 |
| Naval Science | 9.70 | 9.70 | .00 | | | | | |
| Sociology | 9.99 | 2.45 | 7.54 | 4,229 | 40 | 19 | 21 | 20 |
| Psychology | 12.88 | 3.62 | 9.26 | 3,151 | 21 | 31 | 26 | 22 |
| Atmospheric Sci | 15.94 | 6.42 | 9.52 | 2,532 | 16 | 29 | 42 | 13 |
| Computer Science | 17.25 | 4.10 | 13.15 | 2,783 | 17 | 23 | 39 | 21 |
| Economics | 17.96 | 6.17 | 11.79 | 2,112 | 44 | 21 | 19 | 16 |
| Political Sci | 21.29 | 4.91 | 16.38 | 2,889 | 31 | 23 | 38 | 8 |
| Statistics | 23.99 | 4.97 | 19.02 | 2,110 | 38 | 35 | 12 | 15 |
| Biological Sci | 24.06 | 10.86 | 13.20 | 2,779 | 21 | 28 | 32 | 19 |
| Construction Tech | 26.29 | 10.28 | 16.01 | 2,592 | 19 | 24 | 42 | 15 |
| Military Science | 28.31 | 28.31 | .00 | | | | | |
| Education | 29.58 | 11.80 | 17.78 | 3,114 | 18 | 29 | 41 | 12 |
| Physics | 31.31 | 11.60 | 19.71 | 2,990 | 21 | 31 | 23 | 25 |
| Chemistry | 32.67 | 13.46 | 19.21 | 2,542 | 24 | 30 | 27 | 19 |
| Theatre | 35.23 | 11.22 | 24.01 | 1,986 | 31 | 22 | 36 | 11 |
| English | 35.78 | 7.56 | 28.22 | 2,803 | 30 | 12 | 35 | 23 |
| Agronomy | 36.85 | 14.33 | 22.52 | 2,247 | 41 | 21 | 12 | 26 |
| French | 36.98 | 10.37 | 26.61 | 2,156 | 40 | 31 | 19 | 10 |
| Med Chemistry | 38.58 | 12.74 | 25.84 | 1,803 | 48 | 24 | 19 | 9 |
| Biochemistry | 39.07 | 16.35 | 22.72 | 2,001 | 41 | 32 | 21 | 6 |
| Philosophy | 41.22 | 7.90 | 33.32 | 1,967 | 54 | 27 | 15 | 4 |
| Aero,Astro, Eng. | 43.80 | 17.85 | 25.95 | 1,734 | 19 | 23 | 29 | 19 |
| Physical Educ. | 44.85 | 17.59 | 27.26 | 2,402 | 12 | 24 | 51 | 13 |
| Mechanical Tech. | 46.64 | 19.65 | 26.99 | 1,441 | 23 | 28 | 32 | 17 |
| Audio & Spch Sci. | 51.81 | 21.72 | 30.09 | 1,229 | 41 | 29 | 10 | 20 |
| Electrical Tech. | 56.93 | 26.75 | 30.18 | 1,587 | 37 | 25 | 18 | 20 |
| Nursing | 64.59 | 25.75 | 38.84 | 1,840 | 12 | 38 | 39 | 11 |
| Civil Engineer. | 68.97 | 25.13 | 43.84 | 1,103 | 51 | 26 | 11 | 12 |
| Mechanical Engr. | 71.99 | 36.15 | 35.84 | 1,566 | 21 | 33 | 38 | 8 |
| Russian | 73.40 | 18.78 | 54.62 | 1,422 | 19 | 48 | 19 | 14 |
| Modern Languages | 90.33 | 21.92 | 68.41 | 1,837 | 37 | 22 | 41 | 0 |
| Aviation Tech. | 91.80 | 43.32 | 48.48 | 981 | 28 | 19 | 22 | 31 |
| General Agricul. | 105.79 | 94.06 | 11.73 | 1,621 | 41 | 26 | 9 | 24 |
| Mat Sci & Mtl E. | 107.07 | 67.10 | 39.97 | 1,943 | 35 | 25 | 21 | 19 |
| Entomology | 122.40 | 77.86 | 44.54 | 1,020 | 43 | 21 | 31 | 5 |
| Nuclear Engr. | 126.77 | 67.36 | 59.41 | 892 | 39 | 39 | 20 | 2 |
| Industrial Educ. | 129.30 | 52.08 | 77.22 | 1,433 | 41 | 26 | 19 | 14 |
| Industrial Engr. | 142.44 | 70.40 | 72.04 | 1,002 | 68 | 8 | 7 | 17 |

1. Identify the set of variables available at the institution that might influence or affect departmental direct unit costs. Many of the variables suggested above can be selected from the Data Management Module (DMM) file. Several of those listed, however, must be derived from either institutional records or other files such as the Personnel Data Module (PDM) or the Faculty Activity Module (FAM).

2. Given the interrelationship of variables described in the previous step, the first step toward understanding unit cost differences among departments is to display each of the variables in Figure V.2 (or as many as can be obtained) by department. This results in a display similar to that shown in Table V.3. In Table V.3, only a subset of potential explanatory variables has been selected for display; more variables (or fewer) might be selected for this table depending on the availability of this information and the needs of the institution.

3. There are two ways that a display such as Table V.3 can be used:
   a. For investigating reasons for differences between two departments, a pairwise comparison can be made of the components of direct unit cost for each department. For example, for Table V.2a, it might be of interest to ask why lower division philosophy costs approximately twice as much as lower division political science. Both

departments generate slightly more than 4,000 credit hours, both are liberal arts, and on the surface, there seems to be no reason why they should differ so much in direct unit cost. Examination of the two major components of direct unit cost in Table V.3 shows that faculty compensation per credit hour costs about twice as much for philosophy as for political science ($33.32/SCH versus $16.38/SCH). Also, the remaining component (nonfaculty compensation) of direct unit cost is nearly double that of political science for the philosophy department. (The nonfaculty component in each case accounts for only about 20 percent of the direct unit costs. If this difference seems worth pursuing further, additional columns should be added to Table V.3 showing administrative compensation, clerical and other compensation, and supplies and services costs, all shown per credit hour produced.) Assuming that the faculty compensation is of primary interest, the next step is to examine its components. Table V.3 shows that the distribution of faculty ranks in the two departments is quite different. The philosophy department has more faculty members of a higher rank than does the political science department. This fact indicates (other factors such as salary structure being equal) that faculty members are paid more for teaching the same number of students in the philosophy department. The other component of faculty compensation per credit hour shown in Table V.3, the productivity ratio, also differs for the two departments. The philosophy department produces 1,967 SCH per faculty FTE

while the political science department produces 2,889. This finding can probably be explained in part by the fact that full and associate professors generally have lighter teaching loads, but it also may be possible that classes are smaller, on the average, in the philosophy department. If data are available on average class size and average teaching load (course credits per faculty FTE) in each department, these can be investigated further to explain the productivity ratio difference between the two departments.

b. For investigating the high (or low) cost of a department without reference to any specific department, the components of direct unit cost can be examined as was described in (a) above. An artificial comparison can be created, if appropriate, by averaging the values in all the columns. The components of the single cost under consideration then can be compared to the averages for each variable. Alternatively, the values of the high cost being investigated can be combined with the analyst's prior knowledge about the department and simply be studied for the information both factors provide about the department. Aviation Technology is a good example of this type of single department study. There is no other department that might sensibly be compared to it, yet the department unit cost is so high (and the credit hours produced also high) that the analyst may want to know more about the

underlying cost factors involved. Some of these factors are shown in Table V.3; other cost factors can be displayed if necessary; and still others depend on a knowledge of the peculiarities of the Aviation Technology department (the need for training pilots, rental of airplanes, special expensive equipment, small class sizes, and so forth).

Comments: 1. A simple index of faculty rank in a department (or discipline) can be computed by assigning the numbers 3, 2, 1, and zero to the full, associate, assistant, and other categories of faculty rank. If these numbers then are multiplied by the percentage of faculty in each category, and summed, the result is an index of faculty rank in each discipline. Two examples are the political science and philosophy departments:

Poli Sci: $(3 \times 31) + (2 \times 23) + (1 \times 38) + (0 \times 8) = 177$

Philosophy: $(3 \times 54) + (2 \times 27) + (1 \times 15) + (0 \times 4) = 231$

This index ranges from zero (all teaching in the "other" rank) to 300 (all teaching done by full professors).

2. If the analyses proposed in the procedure just described are done by department, there is little difficulty in using such variables as faculty rank, average class size, average length of service for faculty, average faculty credit hours produced

per FTE, and average starting salaries. If, however, the analyses are done by discipline, then all these variables must be crossed over from instructional departments to disciplines in exactly the same way that salary is crossed over. For example, if a full professor in the sociology department teaches two sociology courses and two psychology courses each year, each discipline receives a proportion (based on the allocation algorithm used for salaries) of a full professor for purposes of computing the percentage of full professors in each discipline.

## Planning and Management Applications

The eventual objective of a study of departmental costs is frequently the control of those costs by the administrator or department manager. In some cases there is a need for actual reduction of costs in a department, a group of departments, or across the institution as a whole. Other instances require that costs be held steady, if not actually reduced, or that cost increases be held to a minimum. These managerial decisions should be improved by an understanding of the factors that make up costs and that lead to cost differences among departments. It is hoped that the cost study procedures described above will increase this understanding and assist in planning and management decisions in the following ways:

- Describing the use of instructional resources and identifying the elements of a department's costs. This information may be especially useful in a feedback mode to department heads.

- Providing cues for action, isolating departments and disciplines that represent extremes of high and low cost and that warrant further investigation and possible remedial action.
- Assisting in the identification of a set of possible actions for the department and for the institution as a whole by pointing out:
  - Opportunities for staffing changes given the possibility of new hires and the status of current faculty with respect to tenure, number of years to retirement, and the like.
  - Possible changes in productivity ratios through the combination of course sections, the creation of new ones, the alteration of course loads.
  - The possibility of changing support staff ratios or rates of expenditure for departmental supplies and services.
- Supporting the validation of earlier resource allocation decisions or, at a minimum, describing the results of those decisions.
- Providing a base for multi-year projections of departmental plans and budgets.

In all of these applications, the availability of cost study data over time may provide additional insights for improved resource allocation and resource use decisions. (The analysis of data over time is discussed briefly in Section VII.) Ultimately, of course, the institution's use of these data and the actions taken will depend on its needs, its goals and plans, and its available options.

## B. Studies of Cost Differences Among Student Programs

As in the procedures for understanding and investigating departmental cost differences, the first steps in understanding student program costs are "getting a feeling" for the data and then isolating program* differences or single programs of interest for further investigation. Because the procedures for these two steps are nearly identical to those described in the department cost study, relatively little discussion will be devoted to them here.

There are several differences between department cost studies and program cost studies that should be pointed out, however, before proceeding further. First, there are fewer cost variables that can be easily associated with programs than there are with departments. This set of variables includes:

- SCH consumed
- Total direct cost
- Direct unit cost
- Total full cost
- Full unit cost.

Second, program costs generally must be investigated in terms of discipline contributions rather than in terms of related explanatory variables. Third, program cost differences often are studied more productively in terms of full costs than in terms of direct costs. Thus the analyses that follow will not emphasize differences in direct costs, although direct costs can be easily substituted for full costs if desired throughout the following procedures.

*The term "program" will be used throughout this section to mean "student degree program" or "student major."

Fourth, in program cost studies there is frequently a greater interest in understanding the cost components of a single program than there is in comparing unit costs among two or more programs.

Procedure: Isolating programs for further investigation.

1. Rank order programs within student level in full unit cost order. Display at least SCH consumed by each program and total full cost (in addition to full unit cost). Total direct cost and direct unit cost may be displayed also if they are of interest. Table V.4 illustrates a table that might result from this kind of display using the Community College data.

2. As in the department cost study, a graph might be prepared of program ranks against full unit costs. Figure V.3 illustrates such a graph from the data in Table V.4.

3. Differences of significant magnitude in program unit costs can be identified from the patterns of costs shown in the Table V.4 or Figure V.3 (see the guidelines given in the department cost study). Alternatively, programs with exceptionally high or low unit costs can be identified for further investigation, if primary interest does not center on comparing program costs.

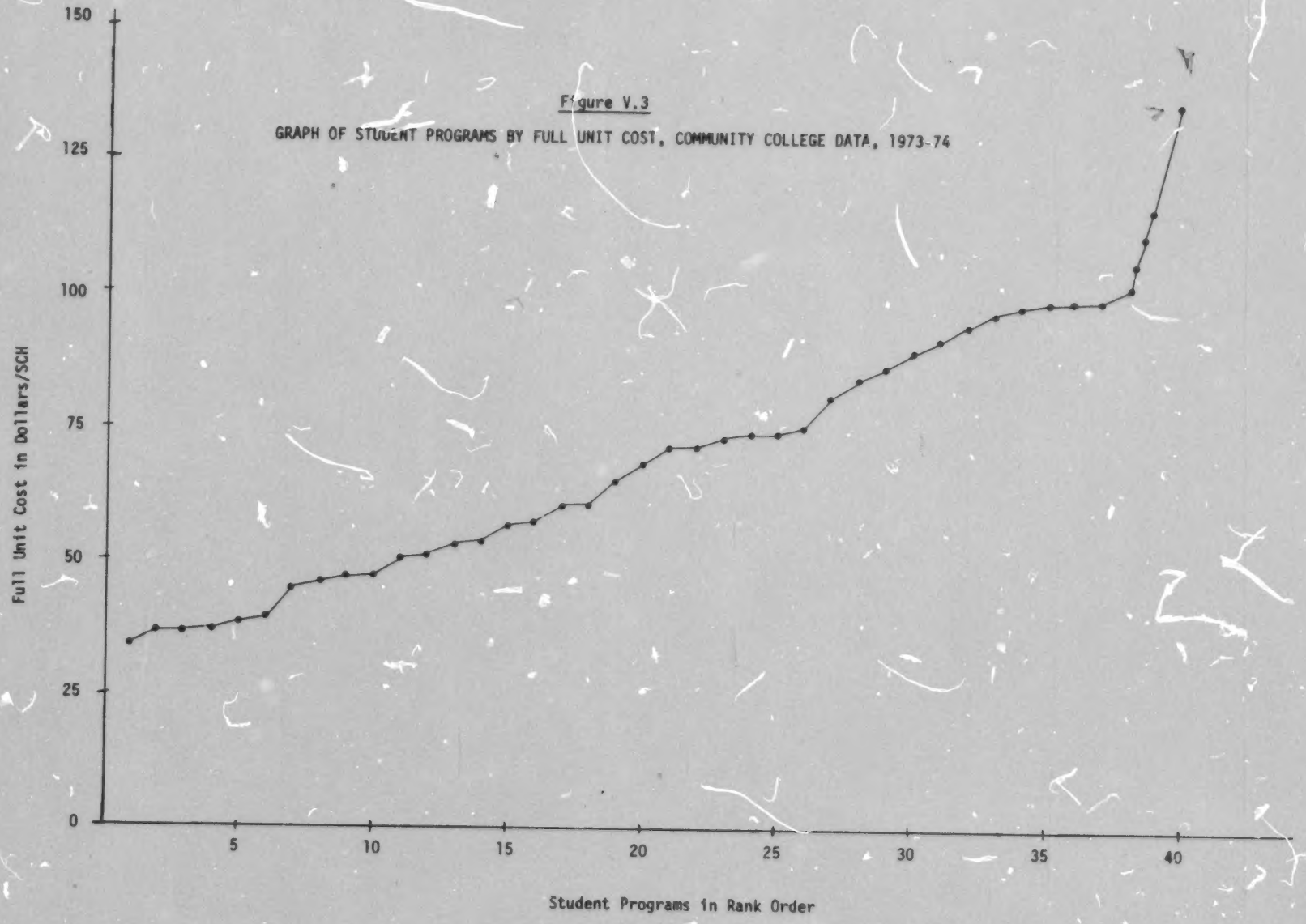
Table V.4

CREDIT HOURS, TOTAL FULL COST, AND FULL UNIT COST BY STUDENT PROGRAM
Community College Data, 1973-74
(Ranked by Full Unit Cost)

| Rank | Student Program Name | Credit Hours | Total Full Cost | Full Unit Cost |
|---|---|---|---|---|
| 1 | GED Test Prep. | 1,834 | $ 62,820 | $ 34.25 |
| 2 | Industrial First Aid | 4,378 | 156,257 | 35.69 |
| 3 | Banking Tech. | 8,117 | 293,059 | 36.10 |
| 4 | English Second Lang. | 11,398 | 426,213 | 37.39 |
| 5 | Fire Protection | 3,207 | 123,111 | 38.39 |
| 6 | Adult Basic Education | 24,871 | 966,344 | 38.85 |
| 7 | Law Enforcement | 2,717 | 119,957 | 44.15 |
| 8 | Real Estate/Insurance | 5,237 | 242,871 | 46.38 |
| 9 | Homemaking | 4,159 | 194,224 | 46.70 |
| 10 | Supervision & Mgmt. | 3,753 | 175,818 | 46.85 |
| 11 | Comm. Service | 6,328 | 313,493 | 49.54 |
| 12 | College Transfer | 143,868 | 7,306,378 | 50.79 |
| 13 | Medical Assisting | 3,247 | 170,935 | 52.64 |
| 14 | Accounting | 12,633 | 669,491 | 53.04 |
| 15 | Recreation & Pub. Service | 2,556 | 144,499 | 56.53 |
| 16 | College Exploratory | 2,246 | 128,070 | 57.02 |
| 17 | Horology | 1,365 | 81,831 | 59.95 |
| 18 | Secretarial | 15,457 | 927,704 | 60.02 |
| 19 | Data Processing | 11,519 | 739,868 | 64.23 |
| 20 | Early Childhood Ed. | 10,723 | 721,481 | 67.28 |
| 21 | Heavy Equipment | 5,481 | 388,491 | 70.88 |
| 22 | Voc/Tech. Teacher Ed. | 1,203 | 85,321 | 70.92 |
| 23 | Electronics | 5,289 | 382,844 | 72.38 |
| 24 | Apprentice | 8,933 | 648,593 | 72.61 |
| 25 | Auto Body Rebuild. | 2,757 | 201,687 | 73.15 |
| 26 | Masonry | 412 | 30,611 | 74.30 |
| 27 | Adv. Art & Comm. Design | 3,552 | 285,260 | 80.31 |
| 28 | Drafting | 7,566 | 633,396 | 83.72 |
| 29 | Machine Shop | 2,150 | 184,461 | 85.80 |
| 30 | Nursing Occ. | 3,679 | 324,731 | 88.27 |
| 31 | Chemical Tech. | 1,130 | 102,354 | 90.58 |
| 32 | Career Guid. for Deaf | 941 | 87,830 | 93.34 |
| 33 | Landscaping | 2,036 | 195,108 | 95.83 |
| 34 | Food Serv. and Hosp. | 10,729 | 1,038,214 | 96.77 |
| 35 | Hotel/Rest. Mgmt. | 3,007 | 292,302 | 97.21 |
| 36 | Graphic Productions | 2,782 | 271,023 | 97.42 |
| 37 | Dental Occ. | 3,589 | 350,305 | 97.61 |
| 38 | Aircraft Mechanics | 8,070 | 807,594 | 100.07 |
| 39 | Pers. Svc., Apparel | 4,059 | 472,642 | 116.44 |
| 40 | Cosmetology | 2,300 | 310,643 | 135.06 |

Figure V.3

GRAPH OF STUDENT PROGRAMS BY FULL UNIT COST, COMMUNITY COLLEGE DATA, 1973-74






100

Procedure: Explaining program cost differences.

The principal mechanism available in IEP for explaining and understanding program unit costs and cost differences is an examination of the Instructional Work Load Matrix (IWLM). A program unit cost is based upon some pattern of SCH consumption from a set of contributing disciplines and upon the unit costs of those disciplines. This discipline contribution information is contained in the IWLM (produced by the Student Data Module software).

This procedure is intended to delineate the relative effects of the amounts and costs of SCH the program consumes, as well as to help separate major or significant impacts from minor impacts. It can be used also to compare programs of interest for unit cost differences due to differing discipline contributions.

1. Select a program for examination and extract the discipline contribution information including the following:
   - SCH contribution
   - Discipline full unit cost
   - Total program full unit cost (optional).

2. Construct a table for each program being studied showing the variables listed in Step 1 by discipline and three derived variables:
   - Percent SCH contributed (discipline SCH divided by total program SCH)
   - Program unit cost component (percent SCH multiplied by discipline unit cost)

Table V.5a

DISCIPLINE CONTRIBUTIONS TO PROGRAM FULL COST, MEDICAL ASSISTING PROGRAM: 3,247 SCH, $52.96/SCH
(Community College Data, 1973-74)

| Discipline Name | SCH | % SCH | Disc. Full Unit Cost | Program Unit Cost Component | % Program Unit Cost Component | Rank |
|---|---|---|---|---|---|---|
| Biology | 10 | .3 | $ 76.03 | $ .23 | .4 | 10 |
| Anatomy | 5 | .2 | 44.53 | .09 | .2 | 12 |
| Art History | 11 | .3 | 34.37 | .10 | .2 | 13 |
| Music (Perform) | 7 | .2 | 73.92 | .15 | .3 | 11 |
| Music (L.A.) | 5 | .2 | 29.32 | .06 | .1 | 25 |
| Spanish | 5 | .2 | 66.16 | .13 | .2 | 14 |
| English | 19 | .6 | 50.17 | .30 | .6 | 8 |
| Speech & Deb. | 10 | .3 | 34.29 | .10 | .2 | 15 |
| Philosophy | 5 | .2 | 49.16 | .10 | .2 | 16 |
| English - Other | 10 | .3 | 41.54 | .12 | .2 | 17 |
| Mathematics | 48 | 1.5 | 48.57 | .73 | 1.4 | 6 |
| Chemistry | 5 | .2 | 56.15 | .11 | .2 | 18 |
| Astronomy | 5 | .2 | 38.15 | .08 | .2 | 19 |
| Oceanography | 5 | .2 | 28.32 | .06 | .1 | 26 |
| Psychology | 70 | 2.2 | 40.44 | .89 | 1.7 | 4 |
| Anthropology | 10 | .3 | 36.55 | .11 | .2 | 20 |
| History | 17 | .5 | 49.19 | .25 | .5 | 9 |
| Geography | 45 | 1.4 | 34.07 | .48 | .9 | 7 |
| Poli. Science | 10 | .3 | 41.48 | .12 | .2 | 21 |
| Sociology | 10 | .3 | 39.59 | .12 | .2 | 22 |
| Criminology | 5 | .2 | 34.22 | .07 | .1 | 27 |
| Pers. Health | 5 | .2 | 33.94 | .07 | .1 | 28 |
| Accounting | 169 | 5.2 | 52.92 | 2.75 | 5.2 | 3 |
| Secretarial | 539 | 16.6 | 65.37 | 10.85 | 20.5 | 2 |
| Nursing-Pract. | 39 | 1.2 | 71.14 | .85 | 1.6 | 5 |
| Medical Asst. | 2,166 | 66.7 | 50.77 | 33.86 | 63.9 | 1 |
| Home Economics | 5 | .2 | 43.68 | .09 | .2 | 23 |
| Recreation | 1 | .0 | 65.88 | .00 | .0 | 29 |
| Community Service | 5 | .2 | 43.51 | .09 | .2 | 24 |
| TOTAL | 3,247 | 100.0* | | $52.96 | 100.0* | |

*Detail may not add due to rounding error.

Table V.5b

DISCIPLINE CONTRIBUTIONS TO PROGRAM FULL UNIT COST, DENTAL OCCUPATIONS PROGRAM: 3,589 SCH, $97.58/SCH
(Community College Data, 1973-74)

| Discipline Name | SCH | % SCH | Disc. Full Unit Cost | Program Unit Cost Component | % Program Unit Cost Component | Rank |
|---|---|---|---|---|---|---|
| Biology | 10 | .3 | $ 58.81 | $ .18 | .2 | 12 |
| Botany | 5 | .1 | 49.27 | .05 | .1 | 18 |
| Art History | 8 | .2 | 34.37 | .07 | .1 | 19 |
| Music (Perform) | 4 | .1 | 73.92 | .07 | .1 | 20 |
| Music (L.A. | 5 | .1 | 29.32 | .03 | .0 | 29 |
| Spanish | 5 | .1 | 57.51 | .06 | .1 | 22 |
| English | 36 | 1.0 | 50.17 | .50 | .5 | 7 |
| Speech & Deb. | 5 | .1 | 34.29 | .03 | .0 | 30 |
| Philosophy | 10 | .3 | 49.16 | .15 | .2 | 13 |
| English (Other) | 15 | .4 | 41.54 | .17 | .2 | 14 |
| Mathematics | 25 | .7 | 39.37 | .28 | .3 | 10 |
| Chemistry | 20 | .6 | 56.15 | .34 | .3 | 11 |
| Oceanography | 10 | .3 | 28.32 | .08 | .1 | 23 |
| Psychology | 40 | 1.1 | 40.44 | .44 | .5 | 8 |
| Psych.-Coun. | 3 | .1 | 43.65 | .04 | .0 | 31 |
| Archaeology | 5 | .1 | 23.26 | .02 | .0 | 32 |
| Economics | 5 | .1 | 47.59 | .05 | .1 | 24 |
| Poli. Science | 5 | .1 | 59.98 | .06 | .1 | 25 |
| Sociology | 5 | .1 | 39.59 | .04 | .0 | 33 |
| Mex.-Amer. Cult. | 5 | .1 | 50.82 | .05 | .1 | 26 |
| Social Sci. Other | 5 | .1 | 57.04 | .06 | .1 | 27 |
| Ind. Sports | 3 | .1 | 145.64 | .15 | .2 | 15 |
| Pers. Health | 6 | .2 | 33.94 | .07 | .1 | 21 |
| Bus.-Commerce | 45 | 1.3 | 43.43 | .56 | .6 | 6 |
| Accounting | 58 | 1.6 | 52.92 | .85 | .9 | 5 |
| Secretarial | 21 | .6 | 65.37 | .39 | .4 | 9 |
| Bus., Comm. Other | 4 | .1 | 51.10 | .05 | .1 | 28 |
| Dental Asst. | 2,156 | 60.1 | 82.88 | 49.81 | 51.0 | 1 |
| Dental Lab. | 842 | 23.5 | 165.75 | 38.95 | 40.0 | 2 |
| Arch. Drafting | 8 | .2 | 92.71 | .18 | .2 | 16 |
| Chemical Tech. | 39 | 1.1 | 121.50 | 1.34 | 1.4 | 4 |
| Home Economics | 2 | .1 | 43.68 | .04 | .0 | 34 |
| Education | 6 | .2 | 75.97 | .15 | .2 | 17 |
| General Educ. | 168 | 4.7 | 48.38 | 2.27 | 2.3 | 3 |
| TOTAL | 3,589 | 100.0* | | $97.58 | 100.0* | |

* Detail may not add due to rounding error

- Percent program unit cost component (program unit cost component for each discipline divided by total program unit cost).

Tables V.5a and V.5b show examples of the resulting displays for the Dental Occupations and Medical Assisting programs from the Community College data. (Note that total full cost is not shown in the tables, although it could easily be added along with the percentage of total full cost for each discipline.)

3. Rank the PROGRAM UNIT COST COMPONENT column by assigning the number "1" to the largest column entry, "2" to the next largest value, and so forth. This results in the completion of Tables V.5a and V.5b.

4. There are at least three ways that these displays can be used to help identify significant discipline cost contributors to program unit costs:

   a. Consider as significant those disciplines with a % PROGRAM UNIT COST COMPONENT at or above some specified level (such as 5%)

   b. Consider as significant the disciplines with ranks between one and N where N is some rank subjectively established by the analyst (for example, consider only the top five contributors)

   c. A combination of (a) and (b) above.

For purposes of using the above guidelines more easily, a second display may be created summarizing the information in Tables V.5a and V.5b.

Table V.6

DISCIPLINE CONTRIBUTORS ABOVE 1 PERCENT TO PROGRAM UNIT COST
(Community College Data, 1973-74)

Medical Assisting Program

| Discipline Name | Rank | % Program Unit Cost Component | Cumulative % Program Unit Cost Component |
|---|---|---|---|
| Medical Asst. | 1 | 63.9 | 63.9 |
| Secretarial | 2 | 20.5 | 84.4 |
| Accounting | 3 | 5.2 | 89.6 |
| Psychology | 4 | 1.7 | 91.3 |
| Nursing-Pract. | 5 | 1.6 | 92.9 |
| Mathematics | | 1.4 | 94.3 |

Dental Occupations Program

| Discipline Name | Rank | % Program Unit Cost Component | Cumulative % Program Unit Cost Component |
|---|---|---|---|
| Dental Asst. | 1 | 51.0 | 51.0 |
| Dental Lab. | 2 | 40.0 | 91.0 |
| General Educ. | 3 | 2.3 | 93.3 |
| Chemical Tech. | 4 | 1.4 | 94.7 |

To construct this display, the discipline contributors should first be reordered form lowest to highest rank. The variables displayed are the discipline and its name, the rank, the % PROGRAM UNIT COST COMPONENT and a new column, CUMULATIVE % PROGRAM UNIT COST COMPONENT. This last column is simply the sum of the percentages at or above each discipline in rank. Table V.6 illustrates this kind of display for the data in Tables V.5a and V.5b.

The CUMULATIVE % column provides an easy-to-use indicator of the amount of discipline cost contributed by any set of disciplines up to a certain rank.

5. Depending on the intent in performing the discipline contribution analysis described above, there are two related approaches for interpreting tables such as V.5 and V.6. If the intent is to explore and understand a single program, some questions that might be asked when examining the tables are:

- Is the program drawing heavily (in terms of SCH) on high-cost (or low-cost) disciplines?
- If the answer is yes, are these high-cost disciplines in the major field? In related fields? In unrelated fields? Are courses in the high-cost disciplines required?
- What would be the effect on the unit cost of the program of changing the program requirements? (Methods for addressing this question are given in the next procedure.)

If the intent in examining discipline contributions to program unit costs is to compare programs, the kinds of questions that should be asked are:

- How similar or different are the patterns of discipline contributions to each program?
- Are there one or two discipline contributors that account for most of the differences between programs, or is the entire pattern of disciplines different?
- If the entire pattern of discipline contributions is different between two programs, does this fact conform to prior expectations? Should the pattern be as different as it seems to be or should steps be taken to align the two programs more closely?

Comments: 1. Direct costs can easily be substituted for full costs throughout the previous procedure.

2. From a curriculum point of view, it may be useful to compare the set of significant discipline contributors for a program with a priori expectations concerning course patterns among the program's students. For these purposes it may be more helpful to use % SCH CONTRIBUTION (rather than % PROGRAM FULL UNIT COST COMPONENT) as the basis for ranking disciplines and for selecting significant contributors. Steps analogous to 3 through 5 above can be used to perform this kind of analysis.

3. An analysis similar to that described in this procedure could be performed on subtotals or aggregations of programs, particularly for purposes of comparing program groups within the institution.

4. A somewhat different kind of analysis, not as heavily focused on costs and SCH, could be performed using the procedures described above. This analysis would be useful when the analyst is interested in investigating cost-related characteristics of discipline contributors to a program, such as the unit cost components shown in Figure V.2 (such as faculty rank, productivity ratio, and average faculty salaries). To investigate the effect these component variables have on programs, the selected variables must first be crossed over from disciplines to programs. The crossover is based on the same allocation scheme as that used for crossing over costs (usually based on SCH). Displays such as those shown as Tables V.5 and V.6 then can be constructed for further investigation of the underlying factors contributing to program costs.

5. If one or two disciplines account for almost all of a program's unit costs, it is often reasonable to equate the contributing discipline (or disciplines) with the program for purposes of further investigation of underlying cost factors. For example, the Dental Occupations Program is made up almost exclusively of courses taken in the Dental Assisting discipline (51%) and the Dental Laboratory discipline (40%). Thus, in this example, most factors that explain the Dental Assisting and Dental Laboratory <u>discipline</u> unit costs also explain the <u>program</u> costs for Dental Occupations.

Procedure: Examining the effects of curriculum changes on program unit costs.

Frequently, an institution or a department is faced with a decision concerning a change in the curriculum for a particular student program. For example, a departmental committee might be considering a requirement for math majors of three additional credit hours of statistics in exchange for three hours currently required in the major field, mathematics. Sometimes the exact course substitutions under consideration are known (such as substituting Statistics 414 for Math 581), and other times only the planned new requirement is known (such as substituting Statistics 414 for any upper division math course currently required).

This procedure is designed to provide guidelines for examining the cost impact of potential curriculum changes such as those suggested above.

1. If the exact course substitution in known, it is reasonable to assume that the number of SCH consumed by the program will remain the same before and after the curriculum change; however, some estimate must be made of the current SCH generated by the course that is to be changed. That is, the SCH contributed to the math program by course number 581 must be estimated. For example, suppose there are 46 math majors affected by this change and that Math 581 is worth three credits:

   46 students x 3 credit hours = 138 SCH.

2. Next, the program full unit cost component must be computed for the SCH contributed by the math and statistics disciplines. For example,

(assuming the math program consumes a total of 5,035 SCH):

| Course | SCH | %SCH | Discipline Full Unit Cost | Program Full Unit Cost Component |
|---|---|---|---|---|
| Statistics, UD | 138 | 2.7 | 62.13 | $1.68 |
| Math, UD | 138 | 2.7 | 96.21 | $2.60 |

3. The difference between the program full unit cost components for the old and new course requirements,

   $1.68/SCH - $2.60/SCH = -$ .92/SCH,

   shows the change that will result in the program full unit cost. If the previous program full unit cost was $48.61, for example, after the proposed curriculum change, the program full unit cost will decrease by almost a dollar per SCH to $47.69.

4. After the first three steps in this procedure have been completed, it is sometimes useful to examine the effect of the curriculum change in terms of total cost to the program. This can be accomplished by simply multiplying the SCH consumed by the program full unit cost. In the first example,

   138 SCH x (-$ .92)/SCH = -$126.96.

   The estimated decrease in total program full cost is $126.96.

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Comments: 1. The NCHEMS Resource Requirements Prediction Model (RRPM) provides a more sophisticated vehicle for this kind of sensitivity analysis. A brief description of RRPM is provided in the appendix.

2. A major assumption of this procedure is that discipline unit cost is a reasonable approximation of the cost of a specific course. In situations where it is known that this assumption is untenable, it may be better to estimate the cost of the course and substitute this value throughout the procedure in place of discipline unit cost.

3. Deleting a course requirement in one program may cause costs to go up for another program in which the particular course is required, because the cost for teaching the course may rise when fewer SCH are produced; this is particularly likely if the number of sections of the course is not reduced, but the class size is, by eliminating the course from one program.

4. Note that when substituting one course for another using this procedure, no estimate has been made of the number of students who already are taking the new course to be required. If it is suspected that a substantial number of students already are taking both the old and the new course, the unit cost change will be much less than that estimated in this procedure.

5. This same procedure can be applied to the situation in which an unspecified course (for example, "any upper division math course") is to be replaced by a specific new course (such as Statistics 414).

Because discipline unit costs are used in this procedure as a proxy for course costs, no modifications are required before using the procedure for this purpose.

6. Numerous variables will change when the curriculum is changed. This procedure examines only the estimated change in costs assuming that all other factors remain constant (such as SCH consumed, number of students in the program, unit cost of the contributing disciplines, and so forth). This procedure should be used and interpreted with caution to the extent that these other factors are not expected to remain constant.

Planning and Management Applications

Since student degree program costs are a reflection of costs in the disciplines, the planning and management applications of departmental cost studies, are relevant also for student progam cost studies. The procedures outlined above, and the data that result from them, have some additional applications due to the student program focus of this section.

- Student program costs may be very high purely as a result of the pattern of courses required and the costs that are tied to them. The cost procedures above will help to establish that fact.
- The pattern of courses taken by students in the program may not match well with what was expected or what is considered an ideal curriculum by the institution. In these cases, the procedures help in investigating the cost implications of curriculum changes if such is considered a feasible course of action.

- The identification of particularly high-cost and low-cost student degree programs may be an important element in decisions concerning program addition, expansion, cutback, or deletion.
- The overall picture of costs of degree programs, coupled with information about expected enrollments, should assist in the preparation of multi-year budget projections. Here again, it will be useful to identify trends in student program costs if data are available to support such analysis.

## C. Estimating and Analyzing Costs per Graduate

In the procedures in this section, full descriptions are given for calculating cost per graduate estimates. Also, variations are suggested, and assumptions underlying both estimation methods and variations are discussed. Following this presentation, procedures are suggested for (1) identifying programs that differ significantly in these costs, and (2) investigating factors that help explain such cost differences.

Procedure: Estimating costs per graduate.

There are three basic approaches to estimating costs per graduate* (the cost of a completed program for one student). The first approach involves determining the actual courses taken in a particular program by examining transcripts of graduates, applying the full unit cost for each course, and adding up the costs for all courses. The second approach differs only in that typical course loads of graduates are determined from catalog or departmental average requirements. The third approach involves fewer data and fewer calculations (assuming that program full unit cost information is available). In this method, full unit costs for each program and student level are multiplied by the average number of upper and lower division credit hours for each graduate, resulting in an estimate of the cost per graduate in each program.

*The term "graduate" will be used throughout this section to refer to a program completer, degree earner, or certificate earner.

1. Transcript Method--To calculate costs per graduate using the transcript method, actual transcripts of program graduates must be retrieved from institutional records and course costs applied to each course taken by graduating students in the program. The total costs estimated for each graduate then are averaged across graduates within each program to get one estimate per program. In practice, there are several shortcuts that may be taken to reduce the cost and time involved in using this method:
   - A random sample of 10-15 transcripts from each program may be selected from the population of all students who graduated in a particular program.
   - Discipline unit cost generally is used as a proxy for the cost of each course within a discipline taken by the graduating student.
   - Discipline unit costs for the current year may be used in place of the discipline unit costs for the actual year in which the student took a particular course. This shortcut is not recommended unless the institution does not have discipline unit costs for previous years.

The actual steps required to compute costs per graduate within a program are summarized as follows:

(a) Retrieve from institutional records all transcripts (or a random sample of transcripts) for graduating students in a program,

(b) Determine the discipline to which each course belongs,

Table V.7a

ESTIMATION OF COST PER GRADUATE
Mathematics Undergraduate Program, Large Research University Data, 1973-74
(Transcript of Student ID 10362992)

| Course | Credit Hours | Discipline | Level | Discipline Full Unit Cost | Course Cost |
|---|---|---|---|---|---|
| Math 301 | 5 | Math | LD | $ 26.92 | $ 134.60 |
| Physics 301 | 4 | Physics | LD | 49.87 | 199.48 |
| English 129 | 3 | English | LD | 52.43 | 157.29 |
| German 413 | 3 | German | UD | 107.08 | 321.24 |
| Math 302 | 5 | Math | LD | 26.92 | 134.60 |
| Physics 302 | 4 | Physics | LD | 49.87 | 199.48 |
| English 158 | 3 | English | LD | 52.43 | 157.29 |
| German 414 | 3 | German | UD | 107.08 | 321.24 |
| Math 351 | 3 | Math | LD | 26.92 | 80.76 |
| Math 401 | 3 | Math | UD | 119.06 | 357.18 |
| Chemistry 301 | 4 | Chemistry | LD | 53.83 | 215.32 |
| Psych 301 | 3 | Psychology | LD | 21.41 | 64.23 |
| Art History 213 | 3 | History | LD | 30.15 | 90.45 |
| Math 402 | 3 | Math | UD | 119.06 | 357.18 |
| Math 416 | 3 | Math | UD | 119.06 | 357.18 |
| Chemistry 302 | 4 | Chemistry | LD | 53.83 | 215.32 |
| Psych 302 | 3 | Psychology | LD | 21.41 | 64.23 |
| Zoology 310 | 4 | Biology | LD | 39.24 | 156.96 |
| Math 510 | 3 | Math | UD | 119.06 | 357.18 |
| Math 482 | 3 | Math | UD | 119.06 | 357.18 |
| English Lit 410 | 3 | English | UD | 80.13 | 240.39 |
| Accounting 301 | 4 | Accounting | LD | 52.13 | 208.52 |
| Botany 311 | 3 | Biology | LD | 39.24 | 117.72 |
| Math 511 | 3 | Math | UD | 119.06 | 357.18 |
| Computer Sci 301 | 3 | Computer Sci | LD | 27.35 | 82.05 |
| Math 483 | 3 | Math | UD | 119.06 | 357.18 |
| English Lit 411 | 3 | English | UD | 80.13 | 240.39 |
| Accounting 302 | 4 | Accounting | LD | 52.13 | 208.52 |
| Math 589 | 3 | Math | UD | 119.06 | 357.18 |
| Math 515 | 3 | Math | UD | 119.06 | 357.18 |
| Poli Sci 211 | 3 | Poli Sci | LD | 33.08 | 99.24 |
| Sociology 301 | 3 | Sociology | LD | 18.12 | 54.36 |
| Engineering 315 | 3 | Fr Engineering | LD | 77.73 | 233.19 |
| Math 599 | 3 | Math | UD | 119.06 | 357.18 |
| Math 516 | 3 | Math | UD | 119.06 | 357.18 |
| Sociology 302 | 3 | Sociology | LD | 18.12 | 54.36 |
| Western Civ 355 | 4 | History | LD | 30.15 | 120.60 |
| Stat 301 | 4 | Math | LD | 26.92 | 107.68 |
| Sociology 414 | 3 | Sociology | UD | 47.04 | 141.12 |
| Accounting 361 | 3 | Accounting | LD | 52.13 | 156.39 |
| TOTAL | 133 | | | | $ 8,506.00 |

(c) Multiply the appropriate discipline full unit costs by the credit hours for each discipline cluster of courses,

(d) Sum the costs over all courses taken by the program graduates, and

(e) Average the results of steps (a) through (d) above over all sampled transcripts in the program. Table V.7a illustrates steps (a) through (d) for the transcript of a student in the mathematics program at the Large Research University.

2. Catalog Requirement Method--To calculate costs per graduate using the catalog (or departmental) requirement method, the first steps are to construct a list of required courses and electives for a particular student program, and then to determine the disciplines associated with these courses. Discipline unit costs then are applied to each corresponding discipline credit hour identified for the student program, and the resulting costs summed over disciplines. (Note that this method differs from the transcript method only in the way in which graduating students' course loads are identified; all other steps are the same.)

In using the catalog requirement method of estimating costs per graduate, two issues must be addressed:

- A decision has to be made whether to use the minimum catalog requirements for a degree (for example, 122 credits for a

bachelor's degree) or to use the typical (average) credits acquired by graduating students (for example, 133 credits). Clearly, the two estimates will differ; in fact, the former method will always yield lower costs per graduate than the latter. For most purposes, the "typical" number of credits is probably the better choice.

- A more troublesome decision must be made about electives allowed in each program. An estimate has to be made of the "typical" content of electives in each program so that appropriate costs can be applied. The suggested method for doing this involves use of the IWLM. Elimination of required courses from this matrix should result in a useable pattern of courses in each program such that an estimate can be made of "typical" electives, and, therefore, of the costs of these electives. Of course, certain programs such as Engineering will have many fewer electives than other programs, such as American Literature.

The actual steps required to compute costs per graduate using the catalog requirements method are:

(a) List the required courses and typical electives for the program,

(b) Determine the discipline to which each required or elective course belongs,

Table V.7b

ESTIMATION OF COST PER GRADUATE IN THE MATHEMATICS UNDERGRADUATE PROGRAM
(Large Research University Data, 1973-74)

(Catalog* Requirement Method, Typical Program of 132** Credit Hours)

| Course Group | Level | SCH | Disc. Full Unit Cost | Discipline Full Cost Component |
|---|---|---|---|---|
| Math | LD | 28 | $ 26.92 | $ 753.76 |
| Math | UD | 20 | 119.06 | 2,381.20 |
| Social Sciences | LD | 15 | 26.71 | 400.65 |
| Life Sciences | LD | 12 | 39.24 | 470.88 |
| Physical Sciences | LD | 18 | 49.87 | 897.66 |
| Physical Sciences | UD | 9 | 103.93 | 935.37 |
| Humanities | LD | 12 | 52.43 | 629.16 |
| Humanities | UD | 18 | 80.13 | 1,442.34 |
| PROGRAM TOTAL | | 132 | | $7,911.02 |

*When computing costs per graduate using the catalog requirement method, particularly for a program with broad electives allowed, the resulting estimate will be very rough. Also, in order to estimate costs using this method, average discipline full unit costs and estimates of SCH must be computed for institutional aggregations of disciplines such as "Social Sciences" or "Humanities."

**This same type of table could have been constructed for the minimum or optimum undergraduate math program consisting of 120 credit hours.

(c) Multiply the appropriate discipline full unit costs by the credit hours for each discipline cluster of courses, and

(d) Sum these costs over all disciplines consumed by the program graduate.

Table V.7b illustrates these steps for the mathematics undergraduate program at the Large Research University.

3. Program Unit Cost Method--To calculate costs per graduate using the program unit cost mehtod, the necessary data are the number of credits per graduate and the program full unit costs for the various student levels within the program of interest. For example, for an undergraduate mathematics program, one would need the program full unit costs for upper and lower division students, and the total number of credits per graduate in each program. As in the catalog requirement method, a decision must be made whether to use the minimum credits for graduation, or the typical credits acquired by graduating students. For most purposes, the typical number of credits is probably preferable.

The cost per graduate using this method involves the following steps:

(a) Obtain the program full unit costs separately by student level,

(b) Determine the typical (or minimum, if desired) number of credits acquired by graduates of the program,

(c) Determine the number of total credits taken by each student level in the program. (For example, in an undergraduate program, determine the number of credits taken by upper and lower division students),

(d) Multiply the program full unit cost for each student level by the number of credits consumed by students in each level, and

(e) Sum the total dollars across student levels.

Using the same example shown in Tables V.7a and V.7b (the Large Research University undergraduate mathematics program), the calculations might look like this:

| Student Level | Total SCH | Full Unit Cost | Total Cost |
|---|---|---|---|
| Lower Division | 70 | $49.88 | $3,491.60 |
| Upper Division | 62 | 97.14 | 6,022.68 |
| TOTAL | 132 | $147.02 | $9,514.28 |

In this example, the estimated cost per graduate of the mathematics program is $9,514.28.

Comments: 1. In each of the methods described above for computing cost per graduate, it is possible to improve the estimates by using unit cost information from previous years if it is available. In the transcript method, the discipline full unit cost is changed to the

unit cost for the appropriate year; in the catalog requirements method, an estimate must first be made of the year in which the current year's graduates took each course; in the third method, lower division costs can be used for two and three years preceding the current year, and upper division costs for the previous and current year.

2. The student program and discipline unit costs in Sections V.A and B above are computed over all students in the institution (some function of the FTE number of students). Costs per graduate, however, are computed only over the headcount number of graduates in a program. Clearly, then, in an institution that has part-time students, nondegree students, transfer students, and full-time students who fail to graduate (dropouts), there are several other costs per program that could be computed beside that for graduates. These costs can be estimated, if desired, using the same procedure described above, with slight modifications to take account of the smaller number of credits taken, the mix of courses taken, and so forth.

3. For most purposes, it makes better sense to compute costs per graduate separately for transfer students versus students who completed all course work at the institution, rather than for transfers and nontransfers combined. This suggestion is made because one generally is interested in the actual cost to the institution of each graduate.

4. The analyst also may want to compute costs per graduate separately for students who were continuously enrolled full-time versus those who were enrolled part-time for some time interval during the program. This separation of part-time and full-time graduate costs will aid in estimating the differential costs of headcount versus FTE student enrollment.

Procedure: Identifying significant differences across programs in costs per graduate.

Regardless of the method used to compute costs per graduate, there generally will be a high correlation between program unit costs and total costs for a graduate in the same program; that is, if program A costs twice as much as program B in terms of unit costs, A also will cost approximately twice as much as B in terms of cost per graduate. For this reason, it is recommended that the steps suggested in the previous cost study, for isolating significant student program unit cost differences, also be used to analyze costs per graduate for significant differences.

Procedure: Explaining differences in cost per graduate.

In this procedure, as in the previous one, the steps outlined in the student program cost study can be used to analyze cost differences per graduate; that is, an examination of discipline contributions to

Table V.8

DISCIPLINE CONTRIBUTIONS TO THE MATHEMATICS UNDERGRADUATE PROGRAM, 1973-74
(Based on the Average of 15 Graduating Students' Transcripts)

| Discipline Name | Level | SCH | % SCH | Disc. Full Unit Cost | Program Unit Cost Component | % Program Unit Cost Component |
|---|---|---|---|---|---|---|
| Biology | LD | 97 | 4.8 | $ 39.24 | $ 1.88 | 3.3 |
| Biology | UD | 42 | 2.1 | 86.69 | 1.82 | 3.2 |
| Botany | LD | 27 | 1.3 | 66.86 | .87 | 1.5 |
| Biochemistry | LD | 32 | 1.6 | 58.72 | .94 | 1.7 |
| Computer Science | LD | 105 | 5.2 | 27.35 | 1.42 | 2.5 |
| Computer Science | UD | 69 | 3.4 | 44.64 | 1.52 | 2.7 |
| Education | LD | 31 | 1.5 | 44.28 | .66 | 1.2 |
| Education | UD | 12 | .6 | 57.03 | .34 | .6 |
| Elec. Eng. | LD | 41 | 2.0 | 99.44 | 1.99 | 3.5 |
| German | LD | 161 | 8.0 | 50.23 | 4.02 | 7.1 |
| German | UD | 40 | 2.0 | 107.08 | 2.14 | 3.8 |
| English | LD | 211 | 10.5 | 52.43 | 5.51 | 9.7 |
| English | UD | 71 | 3.5 | 80.13 | 2.80 | 5.0 |
| Philosophy | UD | 12 | .6 | 66.44 | .40 | .7 |
| Math | LD | 314 | 15.6 | 26.92 | 4.20 | 7.4 |
| Math | UD | 301 | 14.9 | 119.06 | 17.74 | 31.4 |
| Statistics | LD | 81 | 4.0 | 36.96 | 1.48 | 2.6 |
| Statistics | UD | 19 | .9 | 48.19 | .43 | .8 |
| Physics | LD | 101 | 5.0 | 49.87 | 2.49 | 4.4 |
| Physics | UD | 32 | 1.6 | 103.93 | 1.66 | 2.9 |
| Psychology | LD | 28 | 1.4 | 21.41 | .30 | .5 |
| Anthropology | LD | 17 | .8 | 7.46 | .06 | .1 |
| Economics | LD | 72 | 3.6 | 26.71 | .96 | 1.7 |
| Sociology | LD | 98 | 4.9 | 18.12 | .89 | 1.6 |
| TOTAL | | 2,014 | 100.0* | | $ 56.52 | 100.0* |

*Detail may not add due to rounding error.

each program should help explain why costs vary. In examining costs per graduate, however, additional information is available that may further explain variations among programs in total costs per graduate, and this information should be examined in addition to discipline contribution information. The kinds of variables for each program that may be useful in understanding and explaining costs per graduate are:

- o Number of credits required
- o Average number of terms to graduation
- o Average calendar time to graduation (number of years and months from matriculation to graduation)
- o Percentage of part-time and full-time students
- o Percentage of courses at different levels (for example, percentage of lower and upper division courses taken).

1. The first tool needed for investigating differences in cost per graduate is a discipline contribution display similar to that for program cost studies in Tables V.5 and V.6.
   a. If the transcript or catalog requirements method was used to compute cost per graduate, then new tables based on discipline contributions averaged over transcripts (or based on catalog requirements) probably will be more useful than Tables V.5 and V.6. Table V.8 shows an example of a discipline contribution display constructed from the average of several undergraduate mathematics transcripts similar to those shown in Table V.7a.

Table V.9

VARIABLES ASSOCIATED WITH UNDERGRADUATE DEGREE PROGRAMS
Large Research University Data, 1973-74
(Ranked by Cost Per Graduate)

| Program Name | Cost Per Graduate | Number of Graduates | Required Credit Hours | Average Credit Hours | Average * Calendar time to Graduation | % Part-time Students | % Lower Div. Courses |
|---|---|---|---|---|---|---|---|
| Psychology | $ 7,380 | 82 | 122 | 127 | 3.96 | 13.1 | 44.5 |
| Home Econ. | 7,388 | 182 | 122 | 124 | 3.81 | 7.1 | 94.9 |
| Pre-Vet. | 7,662 | 168 | 130 | 133 | 3.82 | 0.0 | 97.4 |
| Forestry | 7,755 | 45 | 134 | 128 | 3.91 | 7.0 | 51.0 |
| Computer Sci. | 7,999 | 72 | 122 | 129 | 3.98 | 8.7 | 53.1 |
| Elem. Educ. | 8,258 | 238 | 122 | 127 | 3.90 | 14.3 | 42.8 |
| Ag. Econ. | 8,495 | 41 | 134 | 144 | 4.23 | 9.6 | 30.3 |
| English | 8,501 | 42 | 122 | 132 | 4.14 | 10.4 | 49.1 |
| Mod. Lang. | 8,767 | 32 | 122 | 131 | 3.90 | 5.5 | 64.1 |
| German | 8,824 | 12 | 122 | 129 | 4.06 | 9.4 | 54.2 |
| Spanish | 8,951 | 7 | 122 | 128 | 4.12 | 8.0 | 53.7 |
| Pharmacy | 9,014 | 162 | 130 | 134 | 4.33 | 14.9 | 25.1 |
| Med. Tech. | 9,023 | 43 | 128 | 136 | 4.25 | 16.3 | 68.0 |
| Biochem. | 9,691 | 15 | 122 | 132 | 4.07 | 11.9 | 43.4 |
| Philosophy | 9,775 | 5 | 122 | 129 | 4.09 | 1.6 | 29.3 |
| Animal Sci. | 9,807 | 99 | 134 | 138 | 4.11 | 14.1 | 30.1 |
| Math. Sci. | 9,850 | 141 | 122 | 134 | 3.84 | 9.7 | 64.9 |
| Agronomy | 9,929 | 36 | 134 | 141 | 4.05 | 12.2 | 33.9 |
| Chemistry | 10,693 | 50 | 122 | 131 | 4.11 | 17.2 | 55.4 |
| Biol. Sci. | 10,746 | 131 | 122 | 132 | 4.21 | 13.4 | 57.6 |
| Pre-Med. | 11,077 | 201 | 130 | 138 | 3.95 | 3.2 | 71.2 |
| Civil Eng. | 13,213 | 119 | 150 | 157 | 4.89 | 17.1 | 27.1 |
| Physics | 14,203 | 22 | 122 | 137 | 4.32 | 21.3 | 65.8 |

*September of entering year to May, 4 years later, is 3.75 calendar years to graduation

b. If the program full unit cost method was used to compute cost per graduate, then the discipline contribution information in Tables V.5 and V.6 is sufficient for investigating cost differences.

The discipline contribution displays from (a) and (b) above should be examined, as described in the student program cost study procedures, for factors that may explain differences in costs per graduate.

2. A second tool available for investigating cost differences is a display by student program of the variables listed in the introduction to this procedure (number of terms to degree, number of credit hours required for each degree, and so forth). Table V.9 illustrates such a display for a sample of programs in the Large Research University. Note that the variables displayed for each degree program will vary from institution to institution depending on what information is available and what information seems relevant. There are three principal sources for obtaining the information listed in Table V.9. The first variable, required credits for program completion, can be obtained from the catalog or the department. All the other variables can be obtained either from institutional records or from an analysis of responses to the Student Outcomes Questionnaire. (All information necessary from the questionnaire is produced by the Student Outcomes Module.)

There are two main points of interest in a display such as Table V.9. First, all degree program costs per graduate are displayed together, and can, therefore, be compared. Second, this table provides information that may be helpful in explaining cost differences. For example, the Pre-Vet and Pre-Med programs logically might be selected for comparison since both are relatively similar in content area, yet the Pre-Med program costs almost one and one-half times as much as the Pre-Vet program for each degree awarded. A comparison of the two programs using the information in Table V.9 yields the following insights:

- Both programs require the same number of credits for graduation, but Pre-Med graduates, on the average, have slightly more credits than Pre-Vet graduates.
- Pre-Med students take slightly longer to complete their program than do Pre-Vet students.
- The Pre-Med program has a few part-time students while the Pre-Vet program has none.
- Ninety-seven percent of the Pre-Vet courses are lower division, while only 71 percent of the Pre-Med courses are lower division. (Note that lower division courses almost always cost less than upper division courses.)

It seems likely that all the differences listed above between the Pre-Vet and Pre-Med programs combine to cause a substantially different cost per graduate in each program. The primary difference, however, is probably in percentage of lower division courses consumed (71.2 percent versus 97.4 percent).

Comment: A display such as Table V.9 can be used for explaining or investigating program-related variables other than cost per graduate. For example, usually there is a relationship between the average calendar time to graduation and the percentage of part-time students in a program. Thus, if students in a particular program take longer on the average to graduate, this fact may be explained by a relatively high percentage of part-time students. The physics program, in Table V.9, provides an example of this reasoning: the average number of years to graduation is one of the highest in the table. Very likely this is explained at least partially by the fact that the physics program also has the highest percentage of part-time students (21.3 percent).

## Planning and Management Applications

The actual planning and management uses of cost per graduate estimates will vary from institution to institution. In many cases, no action will be taken on the basis of this cost study, but the institutional manager will have a better understanding of these costs. In other cases, certain actions may be proposed to try to lower the cost in a particular program based on the results found here. Such actions might include:

- Requiring fewer credits for graduation.
- Assessing higher tuition for credits taken over the required minimum.
- Placing limits on the number of part-time students or on the number of terms a student may be enrolled part-time.
- Changing the mix of courses in the degree program.

- Placing limits on the number of part-time students or on the number of terms a student may be enrolled part-time.
- Changing the mix of courses in the degree program.

# VI

# ANALYSES OF OUTCOMES DATA

This section of the manual provides suggested approaches for analyzing outcomes information across student programs. It is assumed throughout that the institution has performed an outcomes study using the NCHEMS Student Outcomes Questionnaire for Program Completers (see the appendix for a brief description).

The procedures in this section will focus heavily on investigating program differences in outcomes; however, in an outcomes study, perhaps even more than in a cost study, there are may other subgroups (besides student programs) that may be of interest to an institution. Sex differences, ethnic group differences, part-time versus full-time student differences, for example, all may be of substantial interest to an institution in terms of analyzing outcomes. The intent in the procedures that follow is to show how subgroup differences of interest can be investigated, using student program as the primary subgroup example. The reader should recognize, however, that these procedures are general enough to apply to the investigation of many other subgroups.

There is a subtle difference between cost data and outcomes data that is worth pointing out before proceeding further: this is the fact that the variables (or data) associated with costs have a fairly well-defined structure or hierarchy defining the interrelationships among cost variables while outcomes variables do not. Direct costs, for example, can be subdivided into the additive components of direct costs due to faculty compensation and those due to other

expenditures. These two components can, in turn, be subdivided further into additive components and explanatory factors. Outcomes variables, on the other hand, are interrelated in much more complex ways than cost variables and cannot be sorted easily into neat hierarchical structures where a particular variable is explained by a set of additive components. Instead, in outcomes studies it is necessary to pursue questions of interest (for example, Why do more chemistry majors find jobs than math majors?) by examining as many other variables as possible that might be related to the question of interest (for example, Is there a higher percentage of male graduates in the chemistry department than in the math department? Were the grade point averages similar for both types of majors?). Essentially the process of investigating outcomes differences between subgroups is one of sleuthing--attempting to find the underlying reasons for differences and at the same time attempting to eliminate factors that are not responsible for differences. It is just as important to find out that a particular factor <u>does not</u> help explain differences as to find out that another factor <u>does</u> explain outcomes differences.

Related to the structural difference between outcomes and cost data are two additional considerations. First, certain outcome measures, such as the percentage of students who obtain jobs, may not necessarily be comparable across programs without the availability of other data from outside the institution, such as statistics concerning the labor market for different majors or statistics by major field about success in finding jobs in other similar institutions. For example, it may be true that chemistry majors are finding jobs more easily than

math majors across all institutions, and, therefore, that differences between the two programs within a single institution are typical in terms of the national norm. In this case, it would be difficult to find intrainstitutional reasons for a national phenomenon. If an institution does show marked differences in outcomes from similar institutions, or if an institution has prior expectations about certain outcomes that are not realized, then it is appropriate to pursue these outcome differences further, looking for explanatory factors within the institution.

Second, because of the number of outcomes variables and the complexity of their interrelationships, it is usually a good idea to decide on the kinds of questions that are most important and relevant to the institution before doing any analyses. Focusing on specific questions will provide a useful framework for the analyses to be performed and also for the variables to be examined. Some basic areas that are often of high priority to institutions conducting outcomes studies are:

- Length of time to degree completion (calendar time and number of terms)
- Number and percentage of students pursuing and securing jobs
- Relationships of job to major field of study
- Long-range career plans
- Number and percentage of students admitted to other educational programs
- Long-range educational plans
- Students' perception of growth.

## A. Analyses of Outcomes Data

The examples given in the procedures to follow are selected from areas listed above. These areas are investigated to identify student program differences among program completers, and, where differences are found, to pursue the underlying explanatory factors.

The paradigm for performing outcomes analyses is the same as that for the three kinds of cost studies: first, procedures are presented for becoming familiar with the data and for identifying significant program differences in outcomes data; second, procedures are developed for investigating factors that explain or lead to a better understanding of program differences in outcomes.

Procedure: Isolating significant outcomes differences among student programs.

This procedure describes methods for displaying outcomes variables by program and for isolating program differences of sufficient magnitude to warrant further investigation.

1. The first step in investigating student outcomes across programs is to construct a profile of outcomes variables (or those previously selected of interest) for each program. There are a variety of ways in which this can be done, because of the amount of outcomes data available and because of the options available for each questionnaire item in terms of the appropriate summary statistic. For categorical items with no order implied by the various responses (such as item 6, ethnic category), the choices of summary statistics are:

Table VI.1a

LENGTH OF TIME TO UNDERGRADUATE DEGREE IN YEARS*
Private University Outcomes Data, 1973-74
(N = 1349)

| Program Name | Number of Respondents | Mean Number of Years | Standard Deviation** | Percent in Categories of Years ≤ 2 | 3 | 4 | 5+ |
|---|---|---|---|---|---|---|---|
| Architecture | 16 | 4.7 | .9 | 6 | 6 | 12 | 76 |
| Biology | 38 | 3.8 | .7 | 3 | 17 | 77 | 3 |
| General Business | 62 | 3.9 | .5 | 4 | 6 | 81 | 9 |
| Accounting | 148 | 3.9 | .4 | 2 | 3 | 92 | 3 |
| Business Management | 64 | 3.8 | .5 | 7 | 19 | 71 | 3 |
| Marketing | 67 | 3.4 | 1.0 | 19 | 10 | 69 | 2 |
| Communication | 1 | 4.0 | ** | 0 | 0 | 100 | 0 |
| Computing Science | 1 | 4.0 | ** | 0 | 0 | 100 | 0 |
| Engineering, General | 3 | 4.0 | .0 | 0 | 0 | 100 | 0 |
| Engineering, Aerospace | 11 | 4.0 | .4 | 0 | 9 | 81 | 9 |
| Engineering, Chemical | 29 | 3.9 | .4 | 10 | 3 | 80 | 7 |
| Engineering, Civil | 25 | 4.0 | .2 | 4 | 0 | 94 | 2 |
| Engineering, Elect. | 39 | 4.0 | .4 | 3 | 0 | 91 | 6 |
| Engineering, Mech. | 35 | 4.0 | .4 | 0 | 3 | 94 | 3 |
| Engineering, Mining | 5 | 3.8 | .4 | 0 | 20 | 80 | 0 |
| Art | 14 | 3.9 | .5 | 7 | 0 | 86 | 7 |
| Music | 1 | 4.0 | ** | 0 | 0 | 100 | 0 |
| Performing Arts | 6 | 3.5 | .8 | 17 | 33 | 50 | 0 |
| Medicine (Pre-Med) | 128 | 3.9 | .4 | 8 | 7 | 81 | 4 |
| Interdisc. Studies | 30 | 3.8 | .6 | 10 | 7 | 75 | 7 |
| Law (Pre-Law) | 25 | 4.0 | .0 | 0 | 0 | 100 | 0 |
| Classics | 26 | 3.7 | .7 | 8 | 8 | 81 | 4 |
| English | 96 | 3.8 | .7 | 12 | 5 | 76 | 7 |
| Philosophy | 6 | 4.0 | .0 | 0 | 0 | 100 | 0 |
| Mathematics | 34 | 3.6 | .8 | 17 | 3 | 77 | 3 |
| Chemistry | 20 | 3.9 | .3 | 5 | 5 | 85 | 5 |
| Geology | 16 | 3.9 | .6 | 6 | 0 | 88 | 6 |
| Physics | 16 | 3.9 | .6 | 6 | 6 | 76 | 12 |
| Psychology | 44 | 3.6 | .9 | 7 | 14 | 79 | 0 |
| Anthropology | 6 | 3.7 | .8 | 0 | 33 | 67 | 0 |
| Area Studies | 39 | 3.6 | .8 | 21 | 5 | 72 | 3 |
| Economics | 56 | 3.9 | .4 | 7 | 2 | 84 | 7 |
| History | 41 | 3.8 | .9 | 14 | 7 | 76 | 3 |
| Political Science | 122 | 3.9 | .4 | 1 | 6 | 85 | 8 |
| Sociology | 49 | 3.7 | .7 | 12 | 12 | 74 | 2 |
| Theology | 12 | 3.2 | .9 | 17 | 25 | 58 | 0 |
| Other | 1 | 4.0 | ** | 0 | 0 | 100 | 0 |
| TOTAL | 1,332 | 3.9 | .7 | 8 | 5 | 83 | 4 |

17 Missing Responses = 1.3%

*The number of years from September of one year to May, 4 years later, is 3.75.

**Standard deviation cannot be computed for 1 student.

Table VI.1b

NUMBER AND PERCENT SEEKING AND OBTAINING JOBS
Private University Outcomes Data, 1973-74
(N = 1349)

| Program Name | Number of Respondents | Seek Job | | Have Job | | Total (Have or Seek) | |
|---|---|---|---|---|---|---|---|
| | | N | % | N | % | N | % |
| Architecture | 16 | 11 | 69 | 3 | 19 | 14 | 88 |
| Biology | 38 | 10 | 26 | 4 | 10 | 14 | 37 |
| General Business | 63 | 22 | 35 | 23 | 36 | 45 | 71 |
| Accounting | 149 | 26 | 17 | 106 | 71 | 132 | 89 |
| Business Management | 64 | 23 | 36 | 22 | 34 | 45 | 70 |
| Marketing | 67 | 42 | 63 | 17 | 25 | 59 | 88 |
| Communication | 1 | 1 | 100 | 0 | 0 | 1 | 100 |
| Computing Science | 1 | 0 | 0 | 1 | 100 | 1 | 100 |
| Engineering, General | 3 | 1 | 33 | 1 | 33 | 2 | 67 |
| Engineering, Aerospace | 11 | 3 | 27 | 4 | 36 | 7 | 64 |
| Engineering, Chemical | 30 | 1 | 3 | 19 | 63 | 20 | 67 |
| Engineering, Civil | 25 | 6 | 24 | 13 | 52 | 19 | 76 |
| Engineering, Elect. | 41 | 9 | 22 | 24 | 58 | 33 | 80 |
| Engineering, Mech. | 35 | 4 | 11 | 22 | 63 | 26 | 74 |
| Engineering, Mining | 5 | 0 | 0 | 2 | 40 | 2 | 60 |
| Art | 14 | 5 | 36 | 1 | 7 | 6 | 43 |
| Music | 1 | 1 | 100 | 0 | 0 | 1 | 100 |
| Performing Arts | 6 | 4 | 67 | 0 | 0 | 4 | 67 |
| Medicine (Pre-Med) | 128 | 11 | 9 | 3 | 2 | 14 | 11 |
| Interdisc. Studies | 31 | 9 | 29 | 4 | 13 | 13 | 42 |
| Law (Pre-Law) | 25 | 4 | 16 | 1 | 4 | 5 | 20 |
| Classics | 26 | 7 | 27 | 2 | 8 | 9 | 35 |
| English | 95 | 36 | 38 | 8 | 8 | 44 | 46 |
| Philosophy | 6 | 2 | 33 | 1 | 17 | 3 | 50 |
| Mathematics | 35 | 5 | 14 | 16 | 46 | 21 | 60 |
| Chemistry | 20 | 3 | 15 | 8 | 40 | 11 | 55 |
| Geology | 16 | 4 | 25 | 2 | 12 | 6 | 38 |
| Physics | 16 | 2 | 13 | 6 | 38 | 8 | 50 |
| Psychology | 44 | 15 | 34 | 8 | 18 | 23 | 52 |
| Anthropology | 6 | 4 | 67 | 0 | 0 | 4 | 67 |
| Area Studies | 39 | 13 | 33 | 8 | 20 | 21 | 54 |
| Economics | 56 | 22 | 39 | 7 | 12 | 29 | 52 |
| History | 40 | 13 | 33 | 7 | 18 | 20 | 50 |
| Political Science | 123 | 29 | 24 | 13 | 11 | 42 | 34 |
| Sociology | 50 | 27 | 54 | 8 | 16 | 35 | 70 |
| Theology | 12 | 4 | 33 | 1 | 8 | 5 | 42 |
| Other | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTAL | 1,339 | 379 | 28 | 365 | 27 | 744 | 55 |

10 missing responses = .7%

Table VI.1c

NUMBER AND PERCENT APPLYING AND ADMITTED TO ANOTHER EDUCATIONAL PROGRAM
Private University Outcomes Data, 1973-74
(N = 1349)

| Program Name | Number of Respondents | Applied | | Admitted | | % Admitted Of Applied |
|---|---|---|---|---|---|---|
| | | N | % | N | % | |
| Architecture | 16 | 4 | 25 | 1 | 6 | 25 |
| Biology | 38 | 28 | 74 | 18 | 47 | 64 |
| General Business | 62 | 20 | 32 | 14 | 23 | 70 |
| Accounting | 142 | 30 | 21 | 19 | 13 | 63 |
| Business Management | 62 | 24 | 39 | 17 | 27 | 71 |
| Marketing | 67 | 13 | 19 | 11 | 16 | 85 |
| Communication | 1 | 1 | 100 | 0 | 0 | 0 |
| Computing Science | 1 | 1 | 100 | 1 | 100 | 100 |
| Engineering, General | 3 | 1 | 33 | 1 | 33 | 100 |
| Engineering, Aerospace | 12 | 6 | 50 | 3 | 25 | 50 |
| Engineering, Chemical | 29 | 15 | 52 | 10 | 34 | 67 |
| Engineering, Civil | 25 | 9 | 36 | 7 | 28 | 78 |
| Engineering, Elect. | 40 | 14 | 35 | 11 | 28 | 79 |
| Engineering, Mech. | 35 | 12 | 34 | 10 | 29 | 83 |
| Engineering, Mining | 5 | 2 | 40 | 2 | 40 | 100 |
| Art | 13 | 7 | 54 | 5 | 38 | 71 |
| Music | 1 | 0 | 0 | 0 | 0 | 0 |
| Performing Arts | 6 | 2 | 33 | 2 | 33 | 100 |
| Medicine (Pre-Med) | 128 | 125 | 98 | 40 | 60 | 32 |
| Interdisc. Studies | 31 | 21 | 68 | 17 | 55 | 81 |
| Law (Pre-Law) | 25 | 23 | 92 | 13 | 52 | 57 |
| Classics | 26 | 19 | 73 | 15 | 58 | 79 |
| English | 96 | 56 | 58 | 36 | 38 | 64 |
| Philosophy | 6 | 3 | 50 | 3 | 50 | 100 |
| Mathematics | 35 | 13 | 37 | 12 | 34 | 92 |
| Chemistry | 20 | 11 | 55 | 10 | 50 | 91 |
| Geology | 16 | 12 | 75 | 9 | 56 | 75 |
| Physics | 16 | 9 | 56 | 7 | 44 | 78 |
| Psychology | 44 | 25 | 57 | 13 | 30 | 52 |
| Anthropology | 6 | 3 | 50 | 2 | 33 | 67 |
| Area Studies | 39 | 22 | 56 | 16 | 41 | 73 |
| Economics | 56 | 37 | 66 | 27 | 48 | 73 |
| History | 39 | 23 | 59 | 16 | 41 | 70 |
| Political Science | 122 | 92 | 75 | 59 | 48 | 64 |
| Sociology | 49 | 26 | 53 | 15 | 31 | 58 |
| Theology | 12 | 7 | 58 | 5 | 42 | 71 |
| Other | 1 | 0 | 0 | 0 | 0 | 0 |
| TOTAL | 1,325 | 716 | 54 | 447 | 37 | 62 |

24 missing responses = 1.8%

Table VI.1d

MEAN* (AVERAGE) PERCEPTION OF INSTITUTION'S CONTRIBUTION TO GROWTH IN SIX AREAS
Private University Outcomes Data, 1973-74
(N = 1349)

| Program Name | No. of Respondents | Institution's Contribution to Growth | | | | | |
|---|---|---|---|---|---|---|---|
| | | Intellectual | Social | Aesthetic/ Cultural | Educational | Vocational/ Professional | Personal |
| Architecture | 16 | 4.0 | 4.2 | 4.0 | 4.0 | 4.3 | 4.1 |
| Biology | 38 | 3.9 | 3.8 | 3.6 | 3.6 | 3.8 | 3.9 |
| General Business | 63 | 3.7 | 3.9 | 3.6 | 3.7 | 3.8 | 3.8 |
| Accounting | 149 | 3.6 | 3.9 | 3.3 | 4.1 | 4.2 | 3.6 |
| Business Management | 64 | 3.5 | 3.9 | 3.6 | 3.8 | 3.8 | 3.5 |
| Marketing | 68 | 3.8 | 4.0 | 3.6 | 4.2 | 3.9 | 4.1 |
| Communication | 1 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Computing Science | 1 | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Engineering, General | 3 | 4.1 | 3.4 | 3.2 | 3.9 | 3.8 | 3.1 |
| Engineering, Aerospace | 12 | 3.9 | 3.8 | 3.2 | 4.2 | 3.8 | 4.0 |
| Engineering, Chemical | 30 | 4.2 | 3.9 | 3.3 | 4.1 | 4.1 | 4.1 |
| Engineering, Civil | 25 | 4.0 | 4.0 | 3.4 | 4.0 | 4.1 | 3.7 |
| Engineering, Electrical | 41 | 3.9 | 3.8 | 3.5 | 4.4 | 3.9 | 3.5 |
| Engineering, Mechanical | 35 | 4.0 | 3.9 | 3.3 | 3.8 | 3.9 | 3.9 |
| Engineering, Mining | 5 | 4.2 | 3.9 | 3.6 | 3.9 | 4.6 | 3.6 |
| Art | 14 | 3.4 | 3.7 | 3.9 | 4.3 | 3.1 | 3.4 |
| Music | 1 | 3.0 | 4.0 | 4.0 | 3.0 | 3.0 | 4.0 |
| Performing Arts | 6 | 3.4 | 3.9 | 4.7 | 3.9 | 3.8 | 3.9 |
| Medicine (Pre-Med) | 128 | 3.8 | 3.8 | 3.6 | 4.2 | 3.8 | 3.9 |
| Interdisc. Studies | 31 | 3.9 | 3.9 | 4.1 | 4.4 | 3.2 | 3.6 |
| Law (Pre-Law) | 25 | 3.8 | 3.8 | 3.8 | 3.6 | 3.8 | 3.5 |
| Classics | 26 | 3.3 | 3.9 | 4.1 | 3.9 | 3.5 | 3.7 |
| English | 96 | 3.4 | 3.9 | 4.0 | 4.0 | 3.4 | 3.6 |
| Philosophy | 7 | 3.7 | 3.7 | 4.1 | 4.1 | 3.3 | 3.7 |
| Mathematics | 35 | 3.8 | 3.6 | 3.4 | 4.2 | 3.6 | 3.7 |
| Chemistry | 20 | 3.8 | 3.8 | 3.4 | 4.4 | 3.7 | 4.0 |
| Geology | 16 | 3.8 | 3.8 | 3.4 | 4.0 | 3.8 | 3.4 |
| Physics | 16 | 4.1 | 3.8 | 3.4 | 3.8 | 3.9 | 3.5 |
| Psychology | 44 | 3.8 | 3.8 | 3.6 | 4.1 | 3.6 | 3.6 |
| Anthropology | 6 | 3.5 | 4.2 | 4.1 | 3.9 | 3.2 | 4.1 |
| Area Studies | 39 | 3.3 | 3.9 | 4.1 | 4.2 | 3.5 | 4.0 |
| Economics | 58 | 3.6 | 3.9 | 3.7 | 3.7 | 3.5 | 3.6 |
| History | 41 | 3.4 | 3.8 | 3.8 | 3.9 | 3.5 | 3.7 |
| Political Science | 123 | 3.6 | 4.0 | 3.8 | 4.3 | 3.5 | 4.0 |
| Sociology | 50 | 3.7 | 3.9 | 3.7 | 4.2 | 3.6 | 4.0 |
| Theology | 12 | 3.5 | 4.0 | 3.9 | 4.1 | 3.4 | 3.8 |
| Other | 1 | 4.0 | 5.0 | 3.0 | 5.0 | 3.0 | 4.0 |
| TOTAL | 1,346 | 3.7 | 3.9 | 3.6 | 4.1 | 3.7 | 3.7 |

3 missing responses = .2%

*The mean was computed by assigning the numbers one through five to the responses "none" through "very much" on the questionnaire item and then averaging the responses over all students in a program.

- frequency (count) for each response
- percentage for each response
- the mode (the most frequent response).

For items that have an implied order (such as item 16, relatedness of job to major field), the choices of summary statistics are:

- frequency for each response (or frequencies for each category of response if the item is a "fill-in" response, such as salary, that has been categorized)
- percentage for each response
- mode
- mean (the weighted average of responses)
- median (the response or category which is half-way between all other responses)
- standard deviation (a measure of the variablility of the responses).

Tables VI.1a-VI.1d show suggested profile displays of several outcomes variables using a selected set of the summary statistics listed above. Note that the student program codes and program names used in Tables VI.1a-VI.1d (and throughout this section) refer to the "List of Occupations and Educational Programs" found at the end of the Student Outcomes Questionnaire. (The student's program or major field is obtained from his or her response to question 7B of the questionnaire.) It should be noted also that the list of major fields is in program code order on each table,

rather than in rank order for a particular variable as usually suggested for cost displays. This was done primarily to facilitate comparison of variables across tables.

2. The second step in investigating student program differences in outcomes is to examine tables such as VI.1a-VI.1d for statistical values (particularly percentages and/or means) that:
   a. do not agree with prior expectations; for example, (1) do not agree with known national norms for similar institutions, or (2) do not agree with institutional expectations, or (3) do not agree with institutional goals.
   b. are markedly different from the average of all programs (the "Total" line at the bottom of each table).

Examples of the application of these guidelines to Tables VI.1a-VI.1d are:

- Suppose that the average percentage of Pre-Med students in the nation admitted to Medical School by May 15 (the questionnaire administration date) is 60 percent. Table VI.1c shows that for this institution, only 32 percent of 125 applicants have been admitted by May 15. This relatively low percentage compared to the national average of 60 percent is an indication of a potential problem in the Pre-Med program that merits further investigation.
- Fifty-eight percent of English majors have applied for admission to another educational program. If, in previous

years, the percentage averaged about 70 percent, this fact may indicate reason to investigate why fewer numbers of English students plan to go on in school.

- In Table VI.1a several programs (Theology, Marketing, Performing Arts, Psychology, Mathematics, and Area Studies) average less than 3.7 years to the time of degree completion. These programs might be marked for futher investigation of why the average years to degree completion is so low.

Comments: 1. The tables suggested in this procedure (and all analyses in this section) should, in general, be done separately by type of degree.

2. When constructing displays such as VI.1a-VI.1d, the number of respondents (N) should always be one of the columns in the tables. This rule is suggested because summary statistics such as percentages and means must be evaluated with caution when the N is small (10 to 15, or less).

3. Summary tables using aggregations of programs often can be useful in interpreting outcomes data. These tables would show four or five major aggregations of programs (such as life sciences, social sciences, physical sciences, humanities, and fine arts).

Procedure: Explaining outcomes differences across student programs.

There always will be many more unanswered questions about why certain outcome measures have particular values in various programs than there

will be unanswered questions about program or discipline costs. This statement is true because costs can be explained in terms of a finite number of variables associated with each discipline or student program. Outcome variables, on the other hand, summarize the choices and feelings of students within each program, and, therefore, are much more difficult to explain and understand. One or two students in a small- or medium-sized program who have quite different feelings or make different decisions from the others can distort most of the summary statistics for that program.

Nevertheless, certain outcome variations across programs or variations from expected outcomes can be explained, but the process of doing so does not conform to a set of steps applicable in every situation. Rather, the analyst must "track down" leads--variables that might be related to a particular phenomenon. Sometimes an answer will be found and other times it will not be.

For the program or set of programs to be investigated, select variables for examination that might have affected the outcome measures under consideration. For example, some factors that might be related to the low percentage of pre-medical students accepted to medical school are:

- age
- percentage of men versus women
- percentage of minority students
- grade-point average (GPA) of Pre-Med applicants
- rank in college class
- advising done by Pre-Med department.

The questionnaire data can be used to investigate all of these Pre-Med program variables except the last two, and these probably can be pursued, if necessary. (The average age, percent of men and women, percentage of minority students, and GPA are all found on the Student Outcomes Module report generated by student program.) An examination of these variables might show that this institution has 62 percent men and 38 percent women in its Pre-Med program and also that the average GPA is 2.71. If national statistics show that only 12 percent of those admitted to medical school are women and that the average GPA is 3.2, these two facts may, at least partially, explain the low percentage of acceptances from this Pre-Med program.

A second example of investigating outcomes from various programs is given by Table VI.1a. It may be of interest to find out why there are six programs that require less than 3.75 years (the standard four-year degree completion time) for completing a degree. In this case, the obvious starting place is to look at the number and percentage of transfer students in each of these programs compared to the average of all other programs.

| Program Code | Program Name | No. of Respondents | Mean No. of Years | Percentage of Transfers |
|---|---|---|---|---|
| 186 | Marketing | 67 | 3.4 | 29 |
| 335 | Performing Arts | 6 | 3.5 | 50 |
| 600 | Mathematics | 34 | 3.6 | 20 |
| 721 | Psychology | 44 | 3.6 | 21 |
| 784 | Area Studies | 39 | 3.6 | 26 |
| 810 | Theology | 12 | 3.2 | 42 |
| All Other Programs | | 1,138 | 3.9 | 12 |

From the above table, it can be seen that the six programs with low degree completion times also have a substantially higher frequency of transfer students (27 percent for the six programs compared to 12 percent for all other programs).

Comment: A number of analytical techniques that require substantial training in data analysis and statistics (such as analyses of variance, correlation and regression analyses, and nonparametric techniques for categorical data) may be appropriate and useful for analyzing outcomes across the entire institution and within student programs. These will not be discussed here, but the reader is encouraged to investigate the utility of these techniques for his or her institution. (Statistical computer package programs such as SPSS, BMD, and OSIRIS are useful for statistical analyses such as those suggested.)

## Planning and Management Applications

Outcomes studies have numerous planning and management uses, ranging from the simple (availability of data in tabulated form) to the more complex (explanations of why certain outcomes occur). For the most part, these fall under the general headings of program planning and program evaluation. Some or all of the following applications may be appropriate, either in assessing particular programs or in using outcomes data across the institution as a whole.

- Justification of a certain level of student program costs by demonstrating the program's results relative to some norm or expectation.
- Validation of earlier resource allocation decisions by showing an improvement in outcome measures.

- Providing a partial basis for identifying programs that need attention. This identification may take place when certain outcome measures are found to be especially high (for example, drop-out rates) or low (for example, students' perceptions of the institution's contribution to their growth), or when outcome measures--regardless of their level--fail to meet the expectations of the administrator or program manager.
- Furnishing information for students, either in the program or contemplating admission, concerning the results associated with those who have completed the program in the past.
- Estimating the effects of program cuts or program expansion by projecting the likely change in outcome measures, especially those connected with students' occupational and educational plans.

As with cost data, the availability of outcomes data over time should provide additional insights into the processes of resource allocation, resource use, program evaluation, and long-range planning. With outcomes in particular, it may be necessary to examine extra-institutional data (about the labor force, national trends in enrollments for higher degrees, and the like) in order to derive maximum benefit from the institution's own information.

## B. Examination of Student Program Costs and Outcomes

Three studies in the analysis sections of this document so far have focused on student degree programs; they deal with unit costs, costs per graduate, and outcomes. The natural next step would appear to be a set of procedures for combining the results of those studies in the form of a kind of benefit-cost analysis. That step will not be attempted here.

Benefit-cost analysis is a legitimate analytical procedure for many purposes. Its use in postsecondary education at the present time, however, is not well developed. To a large degree the reasons for this are found in the state of the art with respect to measurement on the benefits side of education. The technology exists in many institutions for obtaining very accurate figures on the cost of producing an electrical engineering graduate versus an accounting graduate. Almost nowhere is the same kind of accuracy available for the benefits side of the equation.

Estimates may be made of the projected increased earnings of each type of graduate, taxes that will be paid, charitable donations to be made, and the like. Aside from these, however, what is the benefit to society of having another electrical engineer or accountant in the labor market? What is the benefit to the individual of knowledge gained in addition to the occupational skills resulting from the educational experience? Almost no one denies that such additional benefits exist for both the individual and society. And almost everyone agrees that they are extremely difficult--perhaps impossible--to put in quantitative terms.

Table VI.2

ENROLLMENT, COST, AND OUTCOMES MEASURES FOR SELECTED STUDENT DEGREE PROGRAMS

(Figures invented for purposes of illustration)

| Student Program | Fall 1973 Enrollment* | | 1973-74 Drop-outs* | 1973-74 Grad-uates | 1973-74 Full Unit Costs* | 1973-74 Cost Per Graduate** | Questionnaire Respondents | Average Time to Degree (yrs.) | % Seeking Higher Degree |
|---|---|---|---|---|---|---|---|---|---|
| | Head-count | FTE | | | | | | | |
| Accounting | 454 | 393.4 | 15 | 212 | $ 69 | $ 7,986 | 148 | 3.9 | 21% |
| Electrical Engineering | 182 | 171.8 | 7 | 79 | 126 | 12,896 | 39 | 4.0 | 35 |
| Marketing | 174 | 153.1 | 7 | 81 | 76 | 8,419 | 67 | 3.4 | 19 |
| Medicine | 567 | 564.7 | 43 | 210 | 134 | 13,112 | 128 | 3.9 | 98 |
| Political Science | 561 | 511.2 | 27 | 211 | 75 | 8,264 | 122 | 3.9 | 75 |
| Psychology | 124 | 114.8 | 8 | 49 | 71 | 7,416 | 44 | 3.6 | 57 |

*Upper division only

**Based on transcript analysis

In any event, the kinds of benefits that would need to be included in an institutional benefit-cost analysis are not available in IEP data. The outcomes measures there consist of several measures of process (drop-out rate, time to degree, grade point average, and the like) and student self-reports of educational plans, occupational plans, and perceptions of growth. There are a number of situations in which such outcomes data may be related to cost information, and it is this kind of investigation that is recommended here. Examples of this sort have already been shown in the section on costs per graduate: in Table V.9 several outcomes measures (number of graduates, average years to degree completion) were shown with costs per graduate as possible explanatory variables. In addition, the use of cost and outcomes data together has been mentioned several times in the paragraphs on planning and management applications of a particular set of procedures.

The approach being recommended here is illustrated in Table VI.2. It amounts very simply to looking at a student program's cost data and outcomes data at the same time, examining the patterns and relations among them, and using both kinds of information in drawing conclusions and making decisions. The data in the table are largely invented and they are limited to a small number of measures that the analyst probably will want to examine. The table is meant only to suggest that in some instances cost data and outcomes data will be of more use to the institutional decision maker when they are seen in light of each other.

# VII

# ANALYSIS OF DATA OVER TIME

It was stated early in this document that one of the strong motives for the development of IEP was the belief that comparative analysis of information leads to better decision making. The expression of this belief is the emphasis on exchange of information among institutions. But comparative analysis also may take place, without such exchange, by examining information from a single institution over time. Indeed, this kind of analysis often is more important in carrying out program planning and evaluation functions than is the comparison of data with institutional peers. This section of the manual is designed to identify some prime institutional "subjects" for data analysis over time, to illustrate a general methodology by presenting one example, and to show some ways in which the resulting information may be interpreted and used by the institutional decision maker.

## Subjects for Analysis

The "subjects" for data analysis over time are essentially as numerous as the identifiable components of the institution. The user may want to examine changes in revenue sources over several years on an institution-wide basis, or changes in expenditure patterns among major programmatic activities. It may be important to monitor changes in the characteristics of the student body or the faculty, especially if the institution has established goals related to affirmative action, socioeconomic mix, faculty academic preparation, or student ability measures.

Whatever the "subject" involved, this analysis over time may be carried out for two purposes. The first is simply to provide an historical base for looking at "where we are now" relative to some measure: for example, how does the institution's endowment income for this year compare with that for previous years? The second purpose is to furnish a backdrop of trends over time in a collection of disciplines (or degree programs or support activities) so that changes in a particular one of them may be examined relative to those in the larger group: for example, how does the change in enrollments for business administration programs compare with the changes experienced in the institution's other professional programs?

A general and straightforward set of procedures may be written to accomplish both of these objectives for a particular "subject" of analysis. In keeping with previous sections of this manual, it is suggested that most analyses of data over time within the institution will focus on the department or discipline (and its aggregations) and the student program. This follows from the belief that the institutional user is concerned most often with changes in enrollment, changes in cost, and changes in student outcomes. Therefore, many data analyses over time probably will be of one of the following types:

- Enrollment changes in disciplines
- Enrollment changes in student programs
- Cost changes in disciplines
- Cost changes in student programs
- Changes in outcomes for student programs.

Table VII.1

DISCIPLINE STUDENT CREDIT HOUR COMPARISONS FOR FALL 1972, 1973, AND 1974

Chemistry Discipline Totals

| | NET CHANGE AMT | NET CHANGE % CHG | Fall 74 AMT | % CHG | Fall 73 AMT | % CHG | Fall 72 AMT |
|---|---|---|---|---|---|---|---|
| A. SCH Summary | | | | | | | |
| Lower Division SCH | -265 | -14.8% | 1,526 | -26.0% | 2,061 | +15.0% | 1,791 |
| Upper Division SCH | +167 | +35.3 | 640 | +68.4 | 380 | -19.7 | 473 |
| Undergraduate SCH | -98 | -4.3 | 2,166 | -11.3 | 2,441 | +7.8 | 2,264 |
| Graduate SCH | +9 | +21.4 | 51 | +30.8 | 39 | -7.1 | 42 |
| Total SCH | -89 | -3.9 | 2,217 | -10.6 | 2,480 | +7.5 | 2,306 |
| B. Discipline FTE | | | | | | | |
| Lower Division | -17 | -14.3% | 102 | | 138 | | 119 |
| Upper Division | +11 | +34.4 | 43 | | 25 | | 32 |
| Undergraduate | -6 | -4.0 | 145 | | 163 | | 151 |
| Graduate | +1 | +25.0 | 5 | | 4 | | 4 |
| Total | -5 | -3.2 | 150 | | 167 | | 155 |

| | Fall 1974 | Fall 1973 | Fall 1972 |
|---|---|---|---|
| C. SCH Percent by Course Level | | | |
| % LD SCH to Undergrad SCH | 70.45% | 84.43% | 79.11% |
| % UD SCH to Undergrad SCH | 29.55 | 15.57 | 20.89 |
| % Undergrad SCH to Total SCH | 97.70 | 98.43 | 98.18 |
| % Graduate SCH to Total SCH | 2.30 | 1.57 | 1.82 |
| D. Percentage of Discipline Total SCH to Institutional Total SCH | 2.42% | 2.71% | 2.31% |

The procedure presented below is illustrated with an example of discipline enrollment trends.

Procedure:

The procedure given here has three major parts described in the steps that follow:

- Examine the enrollment trend within the particular discipline.
- Examine the enrollment trend within some aggregation of disciplines.
- Summarize trends across all relevant disciplines in the aggregation.

1. Select the discipline and the time period over which it is to be studied. In the example (see Table VII.1), chemistry is examined over a two-year period (fall 1972 to fall 1974) with one intervening data point (fall 1973).

2. Extract the needed student credit hour (SCH) figures from the summary reports of the Student Data Module (SDM) or the Data Management Module (DMM). In the example, SCH have been extracted separately for lower and upper division and graduate course levels for each of the three fall terms.

3. Calculate the percentage change for each pair of consecutive points in time and the net change, in both SCH amount and percentage, for the total time period. Part A of Table VII.1 shows the results of these three steps.

Table VII.2

DISCIPLINE STUDENT CREDIT HOUR COMPARISONS FOR FALL 1972, 1973, AND 1974

Institutional Totals

| | NET CHANGE AMT | NET CHANGE % CHG | Fall 74 AMT | Fall 74 % CHG | Fall 73 AMT | Fall 73 % CHG | Fall 72 AMT |
|---|---|---|---|---|---|---|---|
| A. SCH Summary | | | | | | | |
| Lower Division SCH | -5,574 | -11.1% | 44,302 | 0 % | 44,301 | -11.1% | 49,876 |
| Upper Division SCH | -3,500 | -7.2 | 44,871 | - .1 | 44,956 | -7.0 | 48,371 |
| Undergraduate SCH | -9,074 | -9.2 | 89,173 | 0 | 89,257 | -9.1 | 98,247 |
| Graduate SCH | +981 | +60.1 | 2,612 | +15.8 | 2,254 | +38 2 | 1,631 |
| Total SCH | -8,093 | -8.1 | 91,785 | +0.3 | 91,511 | -8.3 | 99,878 |
| B. Discipline FTE | | | | | | | |
| Lower Division | -371 | -11.1% | 2,953 | | 2,953 | | 3,325 |
| Upper Division | -233 | -7.2 | 2,992 | | 2,997 | | 3,225 |
| Undergraduate | -604 | -9.2 | 5,945 | | 5,950 | | 6,550 |
| Graduate | +98 | +60.1 | 261 | | 225 | | 163 |
| Total | -506 | -8.1 | 6,206 | | 6,175 | | 6,713 |

| C. SCH Percentages by Course Level | Fall 1974 | Fall 1973 | Fall 1972 |
|---|---|---|---|
| % LD SCH to Undergrad SCH | 49.68% | 49.63% | 50.77% |
| % UD SCH to Undergrad SCH | 50.32 | 50.37 | 49.23 |
| % Undergrad SCH to Total SCH | 97.15 | 97.54 | 98.37 |
| % Graduate SCH to Total SCH | 2.85 | 2 46 | 1.63 |

4. The information in part B of the table is identical to that in part A except that the amounts are in terms of full-time equivalents rather than student credit hours. The percentages, of course, are the same. (In the example, 1 FTE = 15 quarter SCH.) This step is shown for convenience of interpretation of the changes, but it is not essential to the overall procedure.

5. For each point in time, calculate the percent of lower division and upper division SCH to undergraduate SCH for the discipline, and the percentage of undergraduate and graduate SCH to total SCH for the discipline. The results are shown in part C of the table.

6. Part D of Table VII.1 requires extraction of institutional SCH totals from DMM and their division into the corresponding figures for the discipline being examined. This is intended to indicate the relative magnitude of the component under analysis.

7. At this point, enrollment changes in the discipline have been summarized for the two-year period. Before proceeding to guidelines for interpreting those changes, it is useful to look at what has occurred in larger aggregations of disciplines--the Physical Sciences Division, the College of Arts and Sciences, or the institution as a whole. In the example, Table VII.2 shows corresponding information for the whole institution. It is obtained by following steps 2 through 5 above, using institutional figures rather than those for the chemistry discipline.

Table VII.3

NET CHANGE IN UNDERGRADUATE DISCIPLINE SCH FROM FALL 1972 TO FALL 1974

| Sequence | Ranking by SCH Change | | Ranking by SCH Percentage Change | |
|---|---|---|---|---|
| 1 | Institution Total | -9,074 | Honors | >100.0% |
| 2 | Hom Ec, Gen & Ed | -2,393 | Hom Ec, Gen & Ed | -92.4 |
| 3 | Psychology | -2,135 | Radio TV | -53.2 |
| 4 | Education | -2,080 | Humanities | -51.0 |
| 5 | Art | -1,479 | Physics | -46.9 |
| 6 | Anthropology | -1,354 | Philosophy | -46.4 |
| 7 | Sociology | -1,114 | Commun Disorder | -43.6 |
| 8 | Philosophy | -927 | Exploratory Std | -40.9 |
| 9 | Humanities | -795 | Library Sci | -40.0 |
| 10 | Bio Sci | -776 | Anthropology | -32.5 |
| 11 | History | -658 | Health Ed | -30.6 |
| 12 | Physics | -643 | Art | -30.3 |
| 13 | English | -630 | French | -27.6 |
| 14 | Health Ed | -613 | Drama | -22.9 |
| 15 | Geography | -247 | Sociology | -22.5 |
| 16 | Business Ed | -244 | Psychology | -22.1 |
| 17 | Drama | -239 | History | -20.1 |
| 18 | Commun Disorder | -232 | Bio Sci | -20.0 |
| 19 | Pol Science | -176 | Education | -19.1 |
| 20 | French | -156 | Zoology | -18.0 |
| 21 | Zoology | -115 | Geography | -15.5 |
| 22 | Radio TV | -106 | Journalism | -14.2 |
| 23 | Chemistry | -98 | Business Ed | -12.5 |
| 24 | Exploratory Std | -90 | English | -11.3 |
| 25 | Honors | -60 | Pol Science | -10.4 |
| 26 | Journalism | -48 | Institution Total | -9.2 |
| 27 | Library Science | -30 | Social Sciences | -5.9 |
| 28 | Economics | -25 | Botany | -5.3 |
| 29 | Botany | -20 | Chemistry | -4.3 |
| 30 | Social Sciences | -13 | Economics | -1.2 |
| 31 | Chinese | -1 | Chinese | -1.1 |
| 32 | Ind Studies | No Change | Ind Studies | No Change |
| 33 | Safety Ed | +4 | Religious Std | No Change* |
| 34 | Ed Media | +5 | Hom Ec, Consumer | No Change |
| 35 | Foreign Lang | +10 | Health Sci | No Change |
| 36 | AF ROTC | +18 | Hom Ec, Housing | No Change |
| 37 | Science Ed | +52 | Lat Amer Studies | No Change |
| 38 | Leisure Services | +52 | Hom Ec, Textiles | No Change |
| 39 | Comp Science | +56 | Law & Justice | No Change |
| 40 | Early Child Ed | +77 | Hom Ec, Nutrition | No Change |
| 41 | Environmental St | +80 | Hom Ec, Family | No Change |
| 42 | German | +82 | Ed Media | +2.5 |
| 43 | Aerospace | +115 | Safety Ed | +5.1 |
| 44 | Geology | +119 | Physical Ed | +5.6 |
| 45 | Religious Std | +142 | Leisure Services | +5.6 |
| 46 | Hom Ec, Consumer | +168 | Music | +8.3 |
| 47 | Health Sci | +177 | Early Child Ed | +9.5 |
| 48 | Physical Ed | +233 | Geology | +10.9 |
| 49 | Spanish | +320 | Bus Admin | +13.2 |
| 50 | Music | +342 | Foreign Lang | +14.7 |
| 51 | Hom Ec, Housing | +362 | Mathematics | +15.9 |
| 52 | Lat Amer Studies | +381 | German | +16.9 |
| 53 | Hom Ec, Textiles | +395 | AF ROTC | +18.1 |
| 54 | Law & Justice | +426 | Science Ed | +21.8 |
| 55 | Ethnic Studies | +473 | Special Ed | +26.5 |
| 56 | Hom Ec, Nutrition | +529 | Spanish | +26.6 |
| 57 | Hom Ec, Family | +559 | Comp Science | +27.0 |
| 58 | Mathematics | +561 | Aerospace | +30.1 |
| 59 | Tech/Ind Ed | +575 | Environmental St | +40.0 |
| 60 | Special Ed | +660 | Tech/Ind Ed | +55.9 |
| 61 | Bus Admin | +672 | Communications | +100.7 |
| 62 | Communications | +778 | Ethnic Studies | +103.5 |

*Those disciplines that show increases in the "SCH Change" ranking but are labeled "no change" in the "SCH Percentage Change" ranking are new disciplines, created after Fall 1972.

8. The final step in the procedure is a summation of the amount and percentage enrollment change for each discipline included in the aggregation in step 7 (that is, all disciplines in the Physical Sciences Division, or in the institution, and so forth). In the example (Table VII.3), all disciplines in the institution are shown and the net change in undergraduate enrollment over the two-year period is given for each in terms of both SCH change and percentage change. Further, in each instance the disciplines are ranked, from low to high, according to their growth over the two years. This table is intended, for each discipline, to give a notion of "where we stand" in terms of enrollment change relative to the rest of the institution. It is dependent on the completion of steps 2 and 3 above for each discipline included.

Comments: 1. The selection of time points within the overall period for examination of change may be critical to interpretation of the phenomenon observed. In the example for chemistry (Table VII.1, part A), it is seen that lower division SCH declined by 14.8% over the two-year period. But does this really represent a trend? In the year from fall of 1972 to fall of 1973, there was an increase in lower division SCH of 15.0%. The much greater decrease (25.9%) in the following year resulted in an overall decline, but the user would need to examine other factors (such as changes in the chemistry student program) before predicting a continuing decline in the discipline.

2. Similarly, it is important to look at appropriate disaggregations on the vertical dimension of Table VII.1. In the example, the discipline as a whole experienced a decline of only 3.8% over the two years. But this total is the result of a substantial decrease in lower division SCH combined with a substantial increase in upper division SCH. It is noted also that the great drop (25.9%) in lower division SCH from 1973 to 1974 was accompanied by a sizable increase (68.4%) in upper division SCH for the same time period. Further, precisely the reverse phenomenon occurred in the year from 1972 to 1973. The explanations for these changes must lie outside the present set of procedures. Perhaps they result from the service nature of the discipline, or perhaps they represent the lack (or decline) of enrollment of new chemistry majors. Perhaps nothing more mysterious has taken place than a change in the discipline's course numbering system. The point to be made is simply that these procedures for data analysis over time provide a beginning for the examination of change in the institution. They will serve to raise questions for the analyst, but the answers must be pursued through more detailed analyses (such as those given earlier for costs and student outcomes) or through the analyst's ability to uncover institutional factors, not reflected in the IEP data base, that help to explain the observation.

3. The information in Table VII.2 for the whole institution (or its counterpart for a division or school within the institution) furnishes a backdrop for the interpretation of changes in the

discipline. It should be helpful in beginning to determine whether observations for the particular discipline also hold on a larger scale. In the example, the overall SCH decrease in chemistry is repeated institution-wide, but the opposite direction of lower and upper division changes is not. In addition, the proportion of undergraduate SCH in lower and upper divisions is very different for chemistry compared to the whole institution. In a case such as this one, the analyst would not want to draw conclusions for the institution as a whole based on what is happening in chemistry--or vice versa, for that matter.

4. Table VII.3 is similarly intended to give the user a broad perspective for viewing change over the institution. First, it should help the analyst to see the position of a particular discipline under examination within the range of disciplines of which it is a part (in this case, the institution). Second, it will enable the user to identify those disciplines that vary widely from some institutional norm or expectation, either in terms of absolute change or in terms of percentage change--and on either the high or the low side. It is these disciplines that are probably candidates for closer examination. In this regard, it would be useful to add a third column of information showing the magnitude of activity (that is, the total SCH) in each discipline.

5. The procedure described above may be adopted without alteration for the examination of changes in student program enrollments. It is applicable also to analysis over time of cost data for both disciplines and student degree programs. In these instances, it is probably most appropriate to use unit costs, either direct or full, as the basis for analysis. The procedure may be adapted also to the analysis of outcomes data over time. The outcomes measures examined should be selected with care so that the results have meaning for the user. Some measures--for example, the highest degree planned by respondents to the outcomes questionnaire--may require the construction of an index before further analysis over time is undertaken. In addition, many--perhaps most--changes in outcomes will require information about conditions in society at large if proper and useful interpretations are to be made.

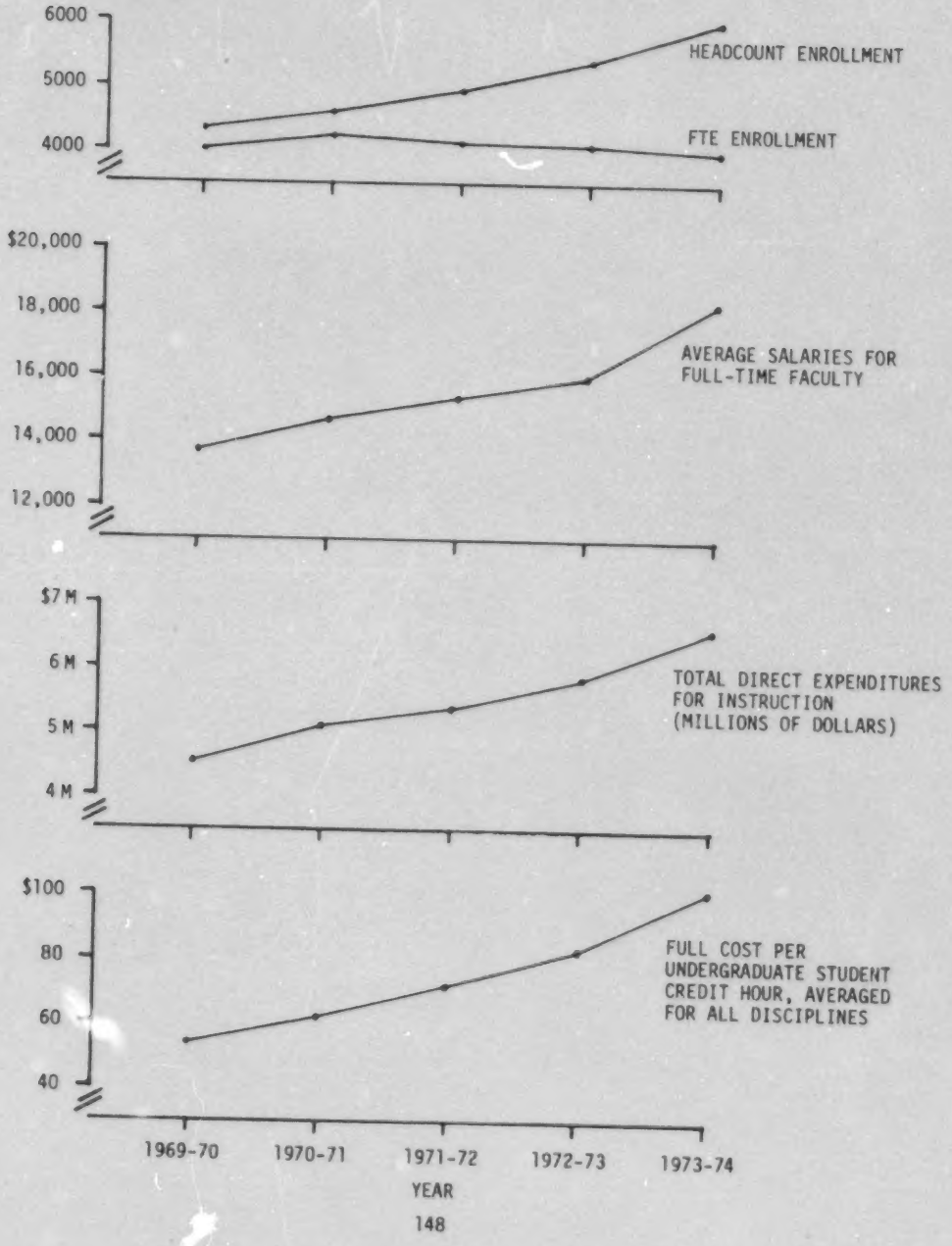
6. This procedure is designed for examining change in a particular discipline or student program relative to changes in a group of disciplines or programs. It may be useful for some purposes to look at one or a few measures over time for the institution as a whole, to provide a basis for interpreting the present picture. Examples of measures that may be of interest in such a "time profile" are:

- Headcount enrollments
- Full-time equivalent enrollments
- Total institutional expenditures
- Total expenditures for instruction

Figure VII.1

SAMPLE GRAPHIC DISPLAYS OF

INSTITUTIONAL DATA OVER TIME



- Unit costs of instruction
- Tuition income as a percentage of total revenues
- Average compensation for full-time faculty
- Percentage of baccalaureate graduates seeking graduate school admission.

These measures--and there are numerous other examples that could be included--lend themselves particularly well to graphic presentation, as is illustrated in Figure VII.1.

## Planning and Management Applications

Probably the most obvious use of the results of data analysis over time is one of simply monitoring the change that takes place in important aspects of the institution's operations. When events flow along in a very even fashion, or change only in very predictable ways, this monitoring may not be a very exciting function; but it is a necessary one if the occasional radical or unexpected change is to be perceived.

It is generally in the areas of program planning, resource allocation, and program evaluation that the more challenging applications of data analysis over time emerge. Changes in enrollment--up and down, from one discipline or student program to another--always have implications for resource allocation in the institution. Usually the enrollment change is actually experienced before the impact on resources is felt and the matter of possible re-allocation is

addressed. To the extent that enrollment trends can be identified among disciplines and student programs, the institutional planner holds an advantage in being able to anticipate the needed re-allocation of present resources or the acquisition of new ones.

In the case of cost data, analysis over time will help in the isolation of disciplines and student programs that are somehow "unusual." Considerable differences in student program unit costs may be very well justified, and a substantial increase in unit costs over the years may be expected. Nonetheless, the program whose unit cost grows proportionately much faster than others may be in need of closer examination. Perhaps the pattern of courses taken by the program's students is changing. Similarly, some disciplines may experience a proportionately slower unit cost increase than others, perhaps through changes in the teaching methods employed. These may serve as examples in making the best use of available resources.

The program evaluation function can bring together all three types of data analyzed over time. Is the program's enrollment growing (or remaining steady) as was expected? Are its costs maintaining a reasonable position relative to those of others? Is it achieving the objectives set for it in terms of student outcomes? Is there a trend visible that shows steady improvement or decline? How does it measure up to similar or related student programs in the institution on all these dimensions? The kinds of questions asked here are a vital part of the program review and evaluation function. To be sure, some of the important questions involved in that function can be answered at a single point in time. But the analysis of student program data over time will almost certainly provide a better basis for informed decision making.

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APPENDIX

## RELATED NCHEMS PRODUCTS

This section contains brief descriptions of four NCHEMS products that are closely related to the analysis and use of IEP data. They are: the Academic Unit Planning Manual, Faculty Activity Analysis, the Outcome Measures and Procedures Manual, and the Resource Requirements Prediction Model. The descriptions given here include references to the documentation for each product. The reader is urged to consult that documentation for more detailed discussions of the products and their uses.

## Academic Unit Planning Manual

The Academic Unit Planning Manual (Technical Report No. 72) is designed to assist in planning and managing the scope and direction of an academic unit's* functions. The manual is intended to help in the identification and organization of data about academic unit functions, the availability and allocation of human and physical resources, the sources and uses of funds, and the planning and assessment of outcomes. Several analytic techniques are included that facilitate the examination of alternatives regarding the allocation of resources, for example, the analysis of various faculty/activity assignments, determination of expected student enrollments, and the uses of financial resources.

The planning manual can be used to address such questions as: How much and what kinds of resources will be consumed by the community service activities conducted by the Home Economics Department? What is the expected student demand if a new course in accounting is established? How many students can be expected to take Educ. 550 during Fall 1975, and from which departments may they come? What are the planned outcomes of the department? How many faculty are needed to staff adequately the projected teaching, research, public service, and administrative functions of the unit?

The manual is designed to be flexible in its use and to rely upon the administrator's experience and judgments in applying the tools to various planning situations.

*For purposes of the manual, the term "academic unit" is used to describe the basic organizational unit within which educational activities such as instruction, research, public service, student counseling and so forth are carried out. For some institutions this would be the academic department; for others the division; and for still others the school or college.

It is organized into several "modules," each of which addresses a particular aspect of the overall planning and management process within academic units: structure, student demand, faculty planning, finance, and outcomes. Each module consists of worksheets for identifying, organizing, and analyzing data, and procedures for helping to investigate a variety of planning and management concerns. The tools and procedures can and should be modified by academic unit administrators to fit their particular situation.

While implementation of the manual can occur at various levels within an institution, it is designed to focus on the academic department. In some cases, however, the school, college, or division will be a more appropriate unit of analysis and the manual may also be used for those organization units.

## Faculty Activity Analysis

The Faculty Activity Analysis: Procedures Manual (Technical Report No. 44) presents the NCHEMS faculty activity survey instrument and discusses the procedural questions involved in conducting a faculty activity survey. Recommended procedures are given where appropriate. Some of the concerns that confront an institution administering an activity survey are identified and discussed, such as the timing of the survey, the possibility of sampling, alternative methods of administration, and the effect of each of these on the resulting data.

Some of the larger issues surrounding a faculty activity analysis also are discussed. These include (1) the question of the accuracy and consistency of faculty activity information, (2) the effect that altering the survey instrument has upon the resulting data, and (3) the general question of faculty acceptance of an activity survey.

Another in the series of Faculty Activity Analysis manuals, Faculty Activity Analysis: Interpretation and Uses of Data (Technical Report No. 54), suggests and illustrates a variety of faculty activity information display formats and analysis techniques. This document outlines a series of display formats that may be useful for describing the faculty resources at an institution, illustrates by use of a case study the utilization of the faculty activity analysis instrument and instructions, and shows how the resultant data can be analyzed to address a number of planning and management issues. Finally, the document describes in a general sense the specifications of a software package that NCHEMS has developed to process part of the faculty activity data.

## Outcome Measures and Procedures Manual

The Outcome Measures and Procedures Manual (Technical Report No. 70) defines a wide range of measures of the outcomes (results or impacts) of postsecondary education institutions and their programs and suggests procedures for acquiring the data needed for each measure.

The outcome measures described in the manual are ones identified by a survey of institutional and state-level decision makers as providing the information most needed about the impacts of postsecondary education. The survey itself is described in another NCHEMS document, The Higher Education Outcome Measures Identification Study (Micek and Arney, 1974).

The procedures presented in the manual are suggested methods for collection of data on each particular outcome measure, often with several alternatives suggested. The procedures are not all-inclusive, but rather are designed to suggest a starting point for institutions wishing to collect the data. Most procedures are relatively straightforward, relying primarily on two methods of data collection: (1) a questionnaire administered to those receiving the benefits of postsecondary education or to those who can determine how many persons received certain benefits, and (2) searches of institutional records.

The manual has been designed so that each outcome measure and its associated data collection procedures are presented separately. As a result, the manual is intended to serve as a flexible and adaptable aid that allows individual users to choose those outcome measures and related data collection procedures most relevant to their outcome information needs.

## Resource Requirements Prediction Model

The Resource Requirements Prediction Model (RRPM) is an instructional cost simulation model for use in all types of postsecondary institutions including community colleges, vocational schools, and large and small four-year institutions with or without major research activities.

RRPM provides institutions with a tool with which to analyze various institutional alternatives for the utilization of a limited set of resources. RRPM may also provide a useful point of departure for those institutions wishing to adapt a cost simulation model to their own specific institutional needs.

RRPM generates information necessary for the preparation of intructional program budgets. Institutional data, either historical or projected, may be put into the model. The model then calculates the program cost information and implied resource requirements to undertake any given series of programs.

RRPM generates four different types of reports, any or all of which may be requested by the user. These include: (1) organizational unit reports providing line-item budgets for various organizational units within the institution, (2) program budget reports indicating the discipline or department contributions to various instructional programs, (3) institutional summary reports, and (4) formatted display reports that show all parameter data for the institution.

The RRPM programs have been written in ANS COBOL and are designed for use on systems having the ANS COBOL compiler and a minimum of 50K bytes of core storage.

# THE NCHEMS COSTING AND DATA MANAGEMENT SYSTEM

## Purpose of the System

The NCHEMS Costing and Data Management System is designed to assist institutions in the implementation of cost studies. There are at least two kinds of cost studies: historical cost studies display cost-related data that reflect actual events over a specified prior time period, and predictive cost studies forecast costs that will be incurred during some future time period. These two kinds of cost studies use different techniques. Historical studies require the identification and aggregation of cost-related data in terms of actual units (dollars, credit hours, and so forth). Predictive studies usually represent an institution in terms of historically derived parameters (such as average section size, faculty rank mix), which then are used as the basis for forecasting costs.

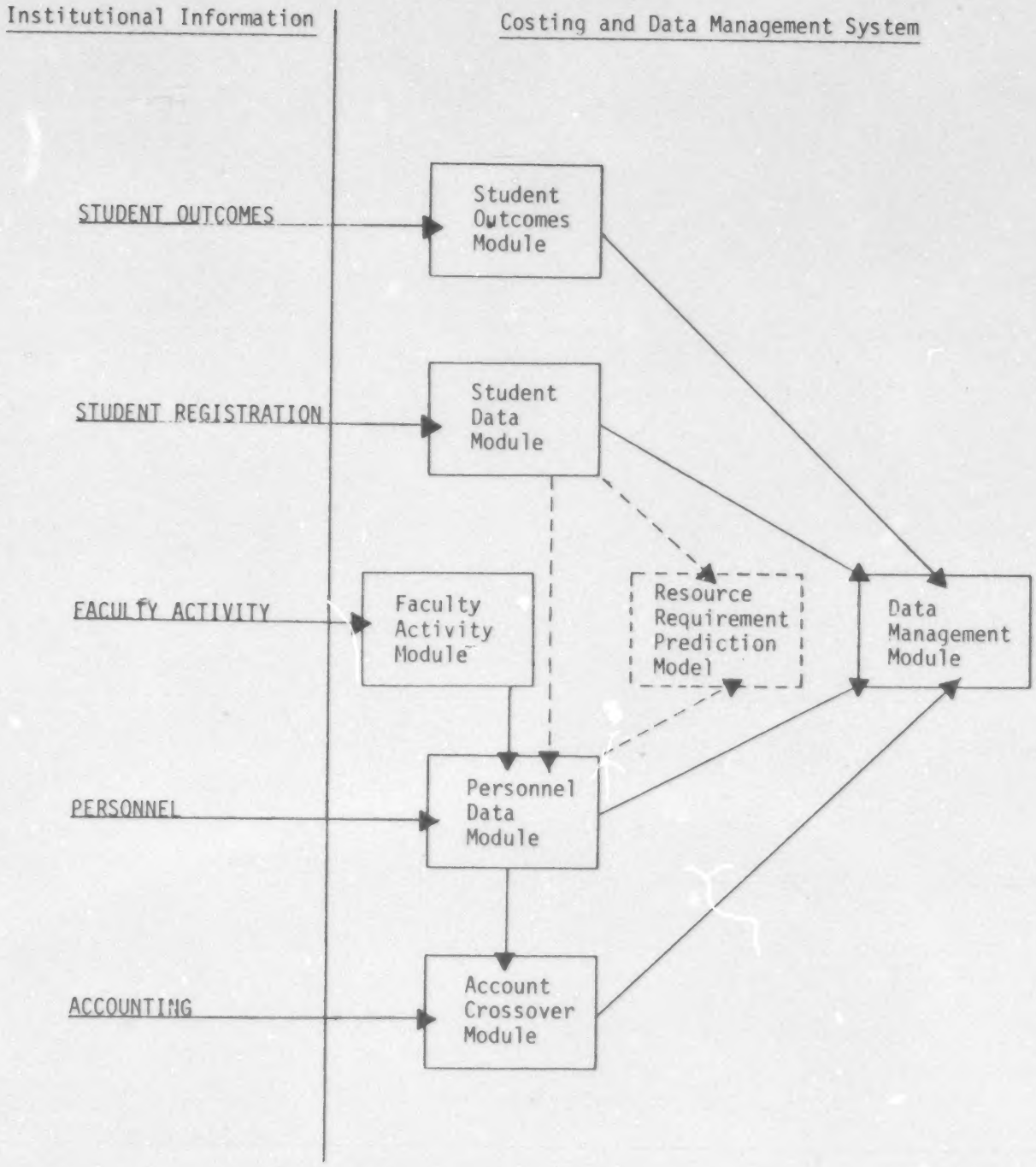
NCHEMS Costing and Data Management System supports both historical and predictive cost studies--specifically, the cost study portion of the Information Exchange Procedures (IEP) and the Resource Requirements Prediction Model (RRPM).

## Institutional Information

The Costing and Data Management System requires information about the institution using the system. Some or all of the following kinds of information will be required to implement this system for either Information Exchange Procedures or Resource Requirements Prediction Model purposes:

FIGURE 1

SYSTEM STRUCTURE



Student Registration Information

Student Outcomes Information

Personnel Information

Faculty Activity Information

Accounting Information

## Structure of the System

The Costing and Data Management System is modular in design. Each module may be used independent of all other modules, or each module may be used in conjunction with other modules or with the Resource Requirements Prediction Model. This modular design allows expansion of the system without requiring major modifications. A separate module processes each of the information types. The modules and the associated institutional information are:

| Modules | Associated Institutional Information |
|---|---|
| Student Data Module | Student Registration Information |
| Student Outcomes Module | Student Outcome Information |
| Personnel Data Module | Personnel Information |
| Faculty Activity Module | Faculty Activity Information |
| Account Crossover Module | Accounting Information |
| Data Management Module | Stores and manipulates information from the other modules |

Figure 1 shows each module's relationship to the system. Note that the Data Management Module does not directly accept institutional information, but rather is a storage and manipulation mechanism for in.ormation obtained from the other modules.

System Capabilities

This system is a tool in support of costing projects. The following capabilities are provided:

- Editing

  All institutional information is subjected to a detailed edit.

- Summarizing

  Summaries of student demand, faculty staffing, and departmental contribution are calculated.

- Manipulating

  Information may be scaled, weighted, and otherwise manipulated in many of the modules.

- Converting

  Some modules have the capability to convert unique institutional codes (such as major or discipline) into a uniform standard code (such as the HEGIS taxonomy).

- Reporting

  Each module produces reports displaying errors encountered as well as results of processing. The Data Management Module includes a limited report writer.

- Storing

  The system provides a generalized information storage capability.

The system is basically independent of NCHEMS definitions and structures. This allows the use of any structure, be it the NCHEMS Program Classification Structure (as in Information Exchange Procedures) or the institution's own accounting structure. Similarly, the institution's definition of direct cost can be used in lieu of the Information Exchange Procedures direct cost definition. The information storage mechanism in the Data Management Module has been designed also to allow institutional definitions. Therefore any information may be stored, regardless of any Information Exchange Procedures or Resource Requirements Prediction Model requirements.

Documents that are used in conjunction with the system include:

An Introduction to the NCHEMS Costing and Data Management System, Technical Report No. 55

An Introduction to the Resource Requirements Prediction Model 1.6, Technical Report No. 34A

Faculty Activity Analysis Procedures Manual, Technical Report No. 44

NCHEMS Costing and Data Management System--Sample Reports, Technical Report No. 56

Account Crossover Module Reference Manual, Technical Report No. 57

Faculty Activity Module Reference Manual, Technical Report No. 58

Personnel Data Module Reference Manual, Technical Report No. 59

Student Data Module Reference Manual, Technical Report No. 60

Student Outcomes Module Reference Manual, Technical Report No. 61

Data Management Module Reference Manual, Technical Report No. 62

IEP Activity Structure, Technical Report No. 63

IEP Data Formats and Definitions, Technical Report No. 64

IEP Cost Study Procedures, Technical Report No. 65

IEP Outcomes Study Procedures, Technical Report No. 66

## IEP STUDENT OUTCOMES MEASURES

The student outcomes measures included in IEP are listed below. With the exception of the first two, which are obtained from institutional records, each of these measures is reported on the Student Outcomes Questionnaire for Program Completers. This questionnaire was developed by NCHEMS especially for use by institutions participating in IEP.

The IEP student outcomes measures are:*

1. The number of program completers for the previous year, by type of certificate or degree awarded and field of study.
2. The number of students who left the institution in the previous year prior to program completion, by type of certificate or degree sought and by their status at exit.
3. The time elapsed between entering the institution and program completion [8].
4. Whether the student transferred credits from another institution [9].
5. The cumulative grade-point average of program completers [10].
6. The number of terms spent in completing the program, full-time and part-time [11].
7. The number of program completers seeking a full-time job [12].

*Bracketed numbers refer to the questionnaire item that yields the information.

8. The number of program completers securing a full-time job [12] and
   a. the type of job [13].
   b. the perceived permanence and career potential of the job [14].
   c. the starting salary or wage [15].
   d. the relation of the job to the field of study [16].
9. The long-run career expectations of program completers [17].
10. The number of program completers applying for admission to another degree program [18] and
   a. the type of degree sought and field of study [19].
   b. the number of applicants who have been admitted [20].
11. The long-run educational intentions of program completers with respect to type of degree and field of study [22].
12. Program completers' perceptions of the institution's contribution to their progress [23] and the importance of that progress [24] in six areas of potential growth:
   a. Intellectual growth
   b. Social growth
   c. Aesthetic and cultural growth
   d. Educational growth
   e. Vocational and professional growth
   f. Personal growth.

Fuller information on IEP outcomes measures may be found in IEP Outcomes Study Procedures, Technical Report No. 66.

# SAMPLE DISPLAYS FROM THE INFORMATION EXCHANGE PROCEDURES DATA FORMATS

This section contains three examples from Information Exchange Procedures Data Formats and Definitions, Technical Report No. 64. The first shows personnel resource information for instruction and research professionals. The other two display unit cost information--one by discipline and course level, the other by student program and student level. Each format is followed by instructions and definitions for its completion.

# LIST OF IEP DATA FORMATS

A.1 General Information
A.2 Statement of the Goals and Missions of the Institution
B.1 Student Information: Demographic Data
B.2 Student Information: Headcount Enrollments
B.3 Student Information: Enrollment Status
B.4 Student Information: Financial Aid
B.5 Student Information: Entering Freshmen Abilities
B.6 Student Information: Basic Tuition and Fee Charges
C.1 Resource Information: Instruction/Research Professionals
C.2 Resource Information: Personnel
C.3 Resource Information: Facilities
D.1 Financial Information: Direct and Full Cost Summary
D.2 Financial Information: Individual or Project Research
D.3 Financial Information: Columnar Balance Sheet
D.4 Financial Information: Current Revenues by Source
D.5 Financial Information: Current Funds Source/Use Format
E.1 Unit Cost Information: By Discipline and Course Level
E.2 Unit Cost Information: By Student Program and Student Level
F.1 Student Outcomes Information: Program Enrollments and Completions
F.2 Student Outcomes Information: Outcomes Questionnaire for Program Completers

NOTE: The data formats have been coded by the type of information displayed on each format. For example, the A's have been reserved for general information, the B's for student information, and so forth. A third digit should be used for data formats that run more than one page, for example, D.1.1 and D.1.2. Sample data are used throughout the document to help the reader understand the formats. The unit cost and student outcomes information is displayed only for selected disciplines and programs. Summary totals are displayed wherever appropriate.

RESOURCE INFORMATION:

INSTRUCTION/RESEARCH PROFESSIONALS

(Fall Term Headcount)

| | DESCRIPTOR | Professor | Associate Professor | Assistant Professor | Lecturer/ Instructor | Teaching Assistant | All Others | TOTALS |
|---|---|---|---|---|---|---|---|---|
| STATUS | Full-Time | 32 | 41 | 79 | 32 | | | 184 |
| | Part-Time | 1 | | 1 | 68 | | | 70 |
| | Tenured | 26 | 28 | 18 | 2 | | | 74 |
| SEX | Male | 30 | 33 | 58 | 60 | | | 181 |
| | Female | 3 | 8 | 22 | 40 | | | 73 |
| CIVIT RIGHTS CATEGORY | American Indian or Alaska Native | | | | | | | |
| | Asian or Pacific Islander | 2 | | 1 | | | | 3 |
| | Black/Negro | | 1 | | 1 | | | 2 |
| | Hispanic | | | | | | | |
| | White, Other Than Hispanic | 31 | 40 | 79 | 99 | | | 249 |
| | Not Reported | | | | | | | |
| HIGHEST DEGREE EARNED | Doctorate | 29 | 24 | 26 | 6 | | | 85 |
| | Master's | 4 | 17 | 52 | 62 | | | 135 |
| | Bachelor's | | | 2 | 27 | | | 29 |
| | All Others | | | | 5 | | | 5 |

| | | | | | | | | Average |
|---|---|---|---|---|---|---|---|---|
| COMPENSATION | Average Full-Time Salary | $ 19,300 | $ 15,910 | $ 13,650 | $ 10,500 | $ | $ | $ 12,800 |
| | Average Full-Time Compensation | $ 20,274 | $ 16,375 | $ 13,974 | $ 11,274 | $ | $ | $ 13,100 |

General: Headcount information in Format C.1 is to be completed for all Instruction/Research Professionals, that is, all individuals employed for the primary purposes of performing instruction and research activities. In most institutions of postsecondary education, these employees are the faculty. As a matter of convention, this category includes department chairmen, but excludes deans.

Full-Time Personnel: Those individuals available for full-time assignment for the period being reviewed or analyzed or those who are designated as "full-time" in an official contract, appointment, or agreement. Normally, those employees who work approximately 40 hours per week for the period being analyzed are considered full-time employees. Individuals who are on sabbatical leave should be included as full-time if that was the status of their employment prior to sabbatical.

Part-Time Personnel: Those individuals available for less than full-time assignment for the period being reviewed or analyzed or those who are designated as "part-time" in an official contract, appointment, or agreement.

Civil Rights Categories: Definitions of civil rights categories do not correspond to strict scientific definitions, but rather to faculty self-reported designations. Fuller descriptions of the categories developed by the Federal Interagency Committee on Education (FICE) can be found opposite Format B.1. While these categories are still tentative, they represent the most timely and substantive contribution to a revision of civil rights categorizations.



Average Salary and Compensation is reported for full-time personnel who are receiving full compensation for their services. This excludes persons who are donating all or some of their services.

Average Full-Time Salary: The average gross salary (excluding fringe benefits) paid to full-time Instruction/Research Professionals for a nine-month period of time. Gross salaries for 11-12 months of actual service (normally 11 months teaching plus one month vacation) should be reduced using a conversion factor of 9/11 (81.8 percent). Equivalent conversions should be used for other lengths of contract. Average full-time salary should be reported for each academic rank.

Average Full-Time Compensation: The average gross salary plus fringe benefits paid to or an behalf of full-time Instruction/Research Professionals for a nine-month period of time. Fringe benefits include the institution's contribution to Social Security, retirement, medical insurance, life insurance, guaranteed disability income protection, unemployment compensation, workmen's compensation, cash tuition for faculty children, cash housing benefits, and other benefits in kind with cash options.

*Data Source: Chief Personnel Officer.*

UNIT COST INFORMATION:
BY DISCIPLINE AND COURSE LEVEL

| Activity Center Code | Discipline | Course Level | Number of Semester Credit Hours | Number of Instructional Service Months | Semester Credit Hours per Instructional Service Month | Discipline Direct Cost | Direct Cost per Semester Credit Hour | Discipline Full Cost | Full Cost per Semester Credit Hour |
|---|---|---|---|---|---|---|---|---|---|
| 1.1.0401.20 | Biology | LD | 4,609 | 154.7 | 29.8 | $ 65,539 | $ 14.22 | $ 158,945 | $ 34.49 |
| 1.1.0401.30 | | UD | 974 | 74.4 | 13.1 | 34,406 | 35.34 | 70,708 | 72.63 |
| 1.1.0401.50 | | GI | 14 | 12.7 | 1.1 | 3,906 | 283.98 | 7,350 | 522.41 |
| 1.1.0501.20 | Business-General | LD | 220 | 24.7 | 8.9 | 24,933 | 113.11 | 47,258 | 214.39 |
| 1.1.0501.30 | | UD | 168 | 7.8 | 21.5 | 57,339 | 340.96 | 105,986 | 630.23 |
| 1.1.0501.50 | | GI | 918 | 183.6 | 5.0 | 21,558 | 23.49 | 46,688 | 50.86 |
| 1.1.0502.20 | Accounting | LD | 1,146 | 145.1 | 7.9 | 11,142 | 9.73 | 30,696 | 26.79 |
| 1.1.0502.30 | | UD | 602 | 98.7 | 6.1 | 7,602 | 12.63 | 19,377 | 32.21 |
| 1.1.0504.30 | Finance | UD | 523 | 435.8 | 1.2 | 1,229 | 2.35 | 6,834 | 13.08 |
| 1.1.0509.20 | Marketing | LD | 906 | 232.3 | 3.9 | 4,922 | 5.43 | 17,038 | 18.81 |
| 1.1.0509.30 | | UD | 1,276 | 146.7 | 8.7 | 13,184 | 10.33 | 35,631 | 27.92 |
| ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ |
| 1.1.2208.20 | Sociology | LD | 3,286 | 290.8 | 11.3 | 17,371 | 5.29 | 60,480 | 18.41 |
| 1.1.2208.30 | | UD | 2,202 | 110.7 | 19.9 | 29,770 | 13.52 | 74,063 | 33.64 |
| | Subtotal-Academic Instruction | | 77,836 | 5,120.8 | 15.2 | $1,683,592 | $ 21.63 | $4,514,488 | $ 58.00 |

General: Unit cost information is calculated only for General Academic Instruction (1.1) and Occupational and Vocational Instruction (1.2). The HEGIS taxonomy is used to designate disciplines.

Course Levels:

Lower Division: Course offerings at a level of comprehension usually associated with freshmen and sophomore students.

Upper Division: Course offerings at a level of comprehension usually associated with junior and senior students. Jointly offered upper division/graduate courses should be classified as upper division.

Graduate: Course offerings at a level of comprehension usually associated with postbaccalaureate students.

Semester Credit (Hour): A unit of measure that represents one student engaged in an instructional activity for a semester for which one credit or fraction thereof is granted upon completion of the activity. The instructional activity may or may not provide credit toward a degree/diploma/certificate upon completion. Semester credit hours should be reported as of the institutional census date for each term included in the fiscal year. Quarter credit hours should be converted to semester credit hours by multiplying the total quarter credit hours by .667.

Instructional Service Month: An instructional activity measure that represents one faculty member (or other staff member) engaged full-time in teaching (or other instructional activities) for a time period of one month. Data regarding instructional service months should be collected for all individuals assigned teaching responsibilities and for all terms included in the fiscal year.



Semester Credit Hours per Instructional Service Month: This measure is calculated by dividing the number of semester credit hours taught within a particular discipline and course level by the instructional service months devoted to those teaching activities.

Discipline Direct Cost: Direct costs by discipline and course level are a further breakdown of the direct cost totals for General Academic Instruction (1.1) and Occupational and Vocational Instruction (1.2) displayed in Format D.1.

Direct Cost per Semester Credit Hour: This measure is calculated by dividing the direct cost of a particular discipline and course level by the semester credit hours taught within that discipline and level.

Discipline Full Cost: Full costs by discipline and course level are a further breakdown of the full cost totals for General Academic Instruction (1.1) and Occupational and Vocational Instruction (1.2) displayed in Format D.1.

Full Cost per Semester Credit Hour: This measure is calculated by dividing the full cost of a particular discipline and course level by the semester credit hours taught within that discipline and level.

*Data Source: Generated in the Data Management Module of the NCHEMS Costing and Data Management System.*

UNIT COST INFORMATION:
BY STUDENT PROGRAM AND STUDENT LEVEL

| Student Program | | | Number of Student Program Credits | Student Program Direct Cost | Direct Cost per Student Program Credit | Student Program Full Cost | Full Cost per Student Program Credit |
|---|---|---|---|---|---|---|---|
| Code | Name | Student Level | | | | | |
| *0509* | *Marketing* | *LD* | *686* | *$ 11,725* | *$17.09* | *$ 27,001* | *$ 39.36* |
| | | *UD* | *1,139* | *24,316* | *21.35* | *53,841* | *47.27* |
| | | *GI* | *13* | *332* | *25.54* | *714* | *54.92* |
| | . | . | . | . | . | . | . |
| | . | . | . | . | . | . | . |
| | . | . | . | . | . | . | . |
| *1501* | *English* | *LD* | *412* | *14,946* | *36.28* | *30,590* | *74.25* |
| | | *UD* | *860* | *43,707* | *50.82* | *87,643* | *101.91* |
| | | *GI* | *295* | *12,336* | *41.82* | *24,758* | *83.93* |
| | *Subtotal--Lower Div.* | | *44,668* | *$ 712,756* | *$15.96* | *$1,919,207* | *$ 42.97* |
| | *Upper Div.* | | *24,052* | *$ 693,661* | *$28.84* | *$1,779,307* | *$ 73.98* |
| | *Graduate* | | *17,180* | *$ 375,475* | *$21.86* | *$1,099,504* | *$ 64.00* |
| | *Total--All Programs* | | *85,900* | *$1,781,892* | *$20.74* | *$4,798,018* | *$ 55.86* |

Student Program Code and Name: The HEGIS Taxonomy for disciplines is used also for designating student programs.

Student Level: For definitions of student levels, see Format B.2.

Student Program Credit: A measure that represents that average semester credit attempted in each student program and at each student level. This measure is obtained through the use of an Instructional Work Load Matrix (IWLM).

Student Program Direct Cost: The direct costs associated with a specific student program.

Direct Cost per Student Program Credit: A measure derived by dividing the direct cost of a program at a particular student level by the number of program credits attempted in that program and student level.

Student Program Full Cost: The full costs associated with a specific student program. This measure is obtained through the use of an IWLM.

Full Cost per Student Program Credit: A measure derived by dividing the full cost of a program at a particular student level by the number of program credits attempted in that program and student level.

*Data Source: Generated in the Data Management Module of the NCHEMS Costing and Data Management System.*

# SAMPLE REPORTS FROM THE NCHEMS COSTING AND DATA MANAGEMENT SYSTEM

This section includes two illustrations of reports from the Costing and Data Management System. The first is taken from the Student Data Module (SDM) and the second from the Data Management Module (DMM). These and other examples may be found in NCHEMS Costing and Data Management System: Sample Reports, Technical Report No. 56.

1. Student Data Module Consumption Report

The following example is taken from the Student Data Module consumption report by student major program (SDM-03). Circled numbers on the report refer to the following notes.

6. This line is the student major program.
7. This line is the student level.
8. This line is the discipline.
9. This line is the course level.
10. This value indicates that the average FTE lower division General Agriculture student "consumed" 2.61 lower division credit hours from the General Agriculture discipline. This was calculated by dividing the total units (72.00) by the number of FTE students (27.60).
11. This value indicates that the 72.00 credit hours are 25.8% of all credit hours produced by the General Agriculture discipline (279.00).
12. This value indicates that the 72.00 credit hours is 13.6% of all credit hours "consumed" by General Agriculture students (531.00).
13. These lines represent total hours by student level.

| | PERCENT TOTAL UNITS MAJR (9) | PERCENT TOTAL UNITS DISC (12) | STUDENT UNITS (11) | UNITS PER F.T.E. (10) |
|---|---|---|---|---|
| 0101 GEN AGRICULTURE (6) | | | | |
| .LD LOWER DIVISION (7) | | | | |
| 0101 GEN AGRICULTURE (8) | | | | |
| .20 LOWER DIVISION | 13.60 | 25.80 | 72.00 | 2.61 |
| .30 UPPER DIVISION | 3.40 | 6.50 | 18.00 | .65 |
| .50 GRADUATE | 1.70 | 3.20 | 9.00 | .33 |
| 0101 GEN AGRICULTURE | 18.60 | 35.50 | 99.00 | 3.59 |
| 0203 INTERIOR DESIGN | | | | |
| .20 LOWER DIVISION | 1.70 | 7.10 | 9.00 | .33 |
| .30 UPPER DIVISION | 1.70 | 7.10 | 9.00 | .33 |
| .50 GRADUATE | 1.70 | 7.10 | 9.00 | .33 |
| 0203 INTERIOR DESIGN | 5.10 | 21.40 | 27.00 | .98 |
| 0301 ASIAN STUDIES | | | | |
| .20 LOWER DIVISION | 1.70 | 7.10 | 9.00 | .33 |
| .30 UPPER DIVISION | 3.40 | 14.30 | 18.00 | .65 |
| .50 GRADUATE | 1.70 | 7.10 | 9.00 | .33 |
| 0301 ASIAN STUDIES | 6.80 | 28.60 | 36.00 | 1.30 |
| 0306 ISLAMIC STUDIES | | | | |
| .20 LOWER DIVISION | 1.70 | 9.10 | 9.00 | .33 |
| .30 UPPER DIVISION | 1.70 | 9.10 | 9.00 | .33 |
| .50 GRADUATE | 1.70 | 9.10 | 9.00 | .33 |
| 0306 ISLAMIC STUDIES | 5.10 | 27.30 | 27.00 | .98 |
| 0420 ECOLOGY | | | | |
| .20 LOWER DIVISION | 3.40 | 18.20 | 18.00 | .65 |
| .30 UPPER DIVISION | 1.70 | 9.10 | 9.00 | .33 |
| .50 GRADUATE | 1.70 | 9.10 | 9.00 | .33 |
| 0420 ECOLOGY | 6.80 | 36.40 | 36.00 | 1.30 |
| 0422 GENETICS | | | | |
| .20 LOWER DIVISION | 1.70 | 9.10 | 9.00 | .33 |
| .30 UPPER DIVISION | 1.70 | 9.10 | 9.00 | .33 |
| .50 GRADUATE | 1.70 | 9.10 | 9.00 | .33 |
| 0422 GENETICS | 5.10 | 27.30 | 27.00 | .98 |
| 0511 REAL ESTATE | | | | |
| .20 LOWER DIVISION | 1.70 | 9.10 | 9.00 | .33 |
| .30 UPPER DIVISION | 1.70 | 9.10 | 9.00 | .33 |
| .50 GRADUATE | 1.70 | 9.10 | 9.00 | .33 |
| 0511 REAL ESTATE | 5.10 | 27.30 | 27.00 | .98 |
| 0512 INSURANCE | | | | |
| .20 LOWER DIVISION | 1.70 | 8.30 | 9.00 | .33 |
| .30 UPPER DIVISION | 1.70 | 8.30 | 9.00 | .33 |
| .50 GRADUATE | 1.70 | 8.30 | 9.00 | .33 |
| 0512 INSURANCE | 5.10 | 25.00 | 27.00 | .98 |
| 0703 DATA PROCESSING | | | | |
| .20 LOWER DIVISION | 1.70 | 4.80 | 9.00 | .33 |
| .30 UPPER DIVISION | 1.70 | 4.80 | 9.00 | .33 |
| .50 GRADUATE | 1.70 | 4.80 | 9.00 | .33 |
| 0703 DATA PROCESSING | 5.10 | 14.30 | 27.00 | .98 |
| 0705 SYSTEMS ANALYSIS | | | | |
| .20 LOWER DIVISION | 1.70 | 6.70 | 9.00 | .33 |

..... E N R O L L M E N T S .....
F.T.E. HEADCOUNT FULL-TIME PART-TIME

| | | PERCENT TOTAL UNITS MAJR | DISC | STUDENT UNITS | UNITS PER F.T.E. | ..... ENROLLMENTS ..... F.T.E. | HEADCOUNT | FULL-TIME | PART-TIME |
|---|---|---|---|---|---|---|---|---|---|
| .30 | UPPER DIVISION | 3.40 | 13.30 | 18.00 | .65 | | | | |
| .50 | GRADUATE | 1.70 | 6.70 | 9.00 | .33 | | | | |
| 0705 | SYSTEMS ANALYSIS | 6.80 | 26.70 | 36.00 | 1.30 | | | | |
| 0801 | GEN EDUCATION | | | | | | | | |
| .20 | LOWER DIVISION | 3.40 | 7.10 | 18.00 | .65 | | | | |
| .30 | UPPER DIVISION | 1.70 | 3.60 | 9.00 | .33 | | | | |
| .50 | GRADUATE | 3.40 | 7.10 | 18.00 | .65 | | | | |
| 0801 | GEN EDUCATION | 8.50 | 17.90 | 45.00 | 1.63 | | | | |
| .LD | LOWER DIVISION | 78.00 | | 414.00 | 15.00 | 27.60 | 16 | 13 | 3 |
| .MA | MASTERS | | | | | | | | |
| 0101 | GEN AGRICULTURE | | | | | | | | |
| .20 | LOWER DIVISION | 1.70 | 3.20 | 9.00 | 2.25 | | | | |
| .50 | GRADUATE | 3.40 | 6.50 | 18.00 | 4.50 | | | | |
| 0101 | GEN AGRICULTURE | 5.10 | 9.70 | 27.00 | 6.75 | | | | |
| 0422 | GENETICS | | | | | | | | |
| .30 | UPPER DIVISION | 1.70 | 9.10 | 9.00 | 2.25 | | | | |
| .MA | MASTERS | 6.80 | | 36.00 | 9.00 | 4.00 | 3 | 3 | |
| .UD | UPPER DIVISION | | | | | | | | |
| 0101 | GEN AGRICULTURE | | | | | | | | |
| .30 | UPPER DIVISION | 8.50 | 16.10 | 45.00 | 8.33 | | | | |
| .50 | GRADUATE | 1.70 | 3.20 | 9.00 | 1.67 | | | | |
| 0101 | GEN AGRICULTURE | 10.20 | 19.40 | 54.00 | 10.00 | | | | |
| 0511 | REAL ESTATE | | | | | | | | |
| .30 | UPPER DIVISION | 1.70 | 9.10 | 9.00 | 1.67 | | | | |
| 0512 | INSURANCE | | | | | | | | |
| .20 | LOWER DIVISION | 1.70 | 8.30 | 9.00 | 1.67 | | | | |
| 0703 | DATA PROCESSING | | | | | | | | |
| .20 | LOWER DIVISION | 1.70 | 4.80 | 9.00 | 1.67 | | | | |
| .UD | UPPER DIVISION | 15.30 | | 81.00 | 15.00 | 5.40 | 2 | 2 | |
| 0101 | GEN AGRICULTURE | 100.00 | | 531.00 | 14.35 | 37.00 | 21 | 18 | 3 |

TEST SEQUENCE = STUDENT MAJOR

CONSUMPTION REPORT

ACTIVITY=1.1. ACADEMIC YEAR 01-01-75

| | PERCENT TOTAL UNITS MAJR | DISC | STUDENT UNITS | UNITS PER F.T.E. | ..... ENROLLMENTS ..... F.T.E. | HEADCOUNT | FULL-TIME | PART-TIME |
|---|---|---|---|---|---|---|---|---|
| *PERIOD TOTALS 1.1. ACADEMIC YEAR | | | 1,611.00 | 12.77 | 126.20 | 76 | 56 | 20 |
| .LD LOWER DIVISION | | | 558.00 | 15.00 | 37.20 | 26 | 15 | 11 |
| (13) → .MA MASTERS | | | 423.00 | 9.00 | 47.00 | 22 | 22 | |
| .UD UPPER DIVISION | | | 630.00 | 15.00 | 42.00 | 28 | 19 | 9 |

2. Data Management Module Program Unit Cost Report

The following example is taken from the Data Management Module report of unit costs for student major programs (DMM-07). Circled numbers on the report refer to the following notes.

17. Each section of the PROGRAM UNIT COST REPORT documents the data and calculations related to the calculation of total units, total program cost, and program unit cost for a student program and student level. Each line of a section identifies a discipline and course level that contributed hours to the program and student level to which the entire section applies.

18. The **TOTALS** line shows, for the student program and level, the total program units (36.0000), the total program cost (561.4290), and the program unit cost (15.5953 = 561.4290 ÷ 36.0000).

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PROGRAM UNIT COST REPORT



| PROGRAM | DISCIPLINE | DIR.COST/CR | CREDIT.HOURS | DIRECT.COST |
|---|---|---|---|---|
| PRG.0101.LD | 1.1.0101.20 | 8.9365 | 72.0000 | 643.4280 |
| | 1.1.0101.30 | 15.8333 | 18.0000 | 284.9994 |
| | 1.1.0101.50 | 21.7778 | 9.0000 | 196.0002 |
| | 1.1.0203.20 | 13.2125 | 9.0000 | 118.9125 |
| | 1.1.0203.30 | 29.8919 | 9.0000 | 269.0271 |
| | 1.1.0203.50 | 25.7670 | 9.0000 | 231.9030 |
| | 1.1.0301.20 | 21.6667 | 9.0000 | 195.0003 |
| | 1.1.0301.30 | 21.5741 | 18.0000 | 388.3338 |
| | 1.1.0301.50 | 43.5185 | 9.0000 | 391.6665 |
| | 1.1.0306.20 | 36.9511 | 9.0000 | 332.5599 |
| | 1.1.0306.30 | 41.5806 | 9.0000 | 374.2254 |
| | 1.1.0306.50 | 71.9259 | 9.0000 | 647.3331 |
| | 1.1.0420.20 | 62.2222 | 18.0000 | 1,119.9996 |
| | 1.1.0420.30 | 158.5556 | 9.0000 | 1,427.0004 |
| | 1.1.0420.50 | 255.6296 | 9.0000 | 2,300.6664 |
| | 1.1.0422.20 | 11.0000 | 9.0000 | 99.0000 |
| | 1.1.0422.30 | 9.8889 | 9.0000 | 89.0001 |
| | 1.1.0422.50 | 13.4444 | 9.0000 | 120.9996 |
| | 1.1.0511.20 | 20.7037 | 9.0000 | 186.3333 |
| | 1.1.0511.30 | 32.0278 | 9.0000 | 288.2502 |
| | 1.1.0511.50 | 36.8333 | 9.0000 | 331.4997 |
| | 1.1.0512.20 | 10.3778 | 9.0000 | 93.4002 |
| | 1.1.0512.30 | 23.4444 | 9.0000 | 210.9996 |
| | 1.1.0512.50 | 33.1481 | 9.0000 | 298.3329 |
| | 1.1.0703.20 | 18.7500 | 9.0000 | 168.7500 |
| | 1.1.0703.30 | 28.7037 | 9.0000 | 258.333 |
| | 1.1.0703.50 | 46.0952 | 9.0000 | 432.8568 |
| | 1.1.0705.20 | 101.0000 | 9.0000 | 909.0000 |
| | 1.1.0705.30 | 101.0000 | 18.0000 | 1,818.0000 |
| | 1.1.0705.50 | 102.6667 | 9.0000 | 924.0003 |
| | 1.1.0801.20 | 5.0909 | 18.0000 | 91.6362 |
| | 1.1.0801.30 | 5.5960 | 9.0000 | 50.3640 |
| | 1.1.0801.50 | 19.0185 | 18.0000 | 342.3330 |
| PRG.0101.LD | **TOTALS** | 37.7636 | 414.0000 | 15,634.1448 |
| PRG.0101.MA | 1.1.0101.20 | 8.9365 | 9.0000 | 80.4285 |
| | 1.1.0101.50 | 21.7778 | 18.0000 | 392.0004 |
| | 1.1.0422.30 | 9.8889 | 9.0000 | 89.0001 |
| PRG.0101.MA | **TOTALS** | 15.5953 | 36.0000 | 561.4290 |
| PRG.0101.UD | 1.1.0101.30 | 15.8333 | 45.0000 | 712.4985 |
| | 1.1.0101.50 | 21.7778 | 9.0000 | 196.0002 |
| | 1.1.0511.30 | 32.0278 | 9.0000 | 288.2502 |
| | 1.1.0512.20 | 10.3778 | 9.0000 | 93.4002 |
| | 1.1.0703.20 | 18.7500 | 9.0000 | 168.7500 |
| PRG.0101.UD | **TOTALS** | 18.0111 | 81.0000 | 1,458.8991 |
| PRG.0703.LD | 1.1.0703.20 | 18.7500 | 27.0000 | 506.2500 |

(17) →

(18) →

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| PROGRAM | DISCIPLINE | DIR.COST/CR | CREDIT.HOURS | DIRECT.COST |
|---|---|---|---|---|
| | 1.1.0703.30 | 28.7037 | 9.0000 | 258.3333 |
| | 1.1.0703.50 | 48.0952 | 9.0000 | 432.8568 |
| PRG.0703.LD | **TOTALS** | 26.6099 | 45.0000 | 1,197.4401 |
| PRG.0703.MA | 1.1.0703.50 | 48.0952 | 27.0000 | 1,298.5704 |
| | 1.1.0705.30 | 101.0000 | 9.0000 | 909.0000 |
| | 1.1.0705.50 | 102.6667 | 9.0000 | 924.0003 |
| PRG.0703.MA | **TOTALS** | 69.5905 | 45.0000 | 3,131.5707 |
| PRG.0703.UD | 1.1.0101.20 | 8.9365 | 27.0000 | 241.2855 |
| | 1.1.0101.30 | 15.8333 | 18.0000 | 284.9994 |
| | 1.1.0101.50 | 21.7778 | 18.0000 | 392.0004 |
| | 1.1.0203.20 | 13.2125 | 18.0000 | 237.8250 |
| | 1.1.0203.30 | 29.8919 | 18.0000 | 538.0542 |
| | 1.1.0203.50 | 25.7670 | 27.0000 | 695.7090 |
| | 1.1.0301.20 | 21.6667 | 18.0000 | 390.0006 |
| | 1.1.0301.30 | 21.5741 | 18.0000 | 388.3338 |
| | 1.1.0301.50 | 43.5185 | 9.0000 | 391.6665 |
| | 1.1.0306.20 | 36.9511 | 9.0000 | 332.5599 |
| | 1.1.0306.30 | 41.5606 | 18.0000 | 748.4508 |
| | 1.1.0306.50 | 71.9259 | 9.0000 | 647.3331 |
| | 1.1.0420.20 | 62.2222 | 9.0000 | 559.9998 |
| | 1.1.0420.30 | 158.5556 | 9.0000 | 1,427.0004 |
| | 1.1.0420.50 | 255.6296 | 9.0000 | 2,300.6664 |
| | 1.1.0422.20 | 11.0000 | 9.0000 | 99.0000 |
| | 1.1.0422.30 | 9.8889 | 18.0000 | 178.0002 |
| | 1.1.0422.50 | 13.4555 | 9.0000 | 120.9996 |
| | 1.1.0511.20 | 20.7037 | 9.0000 | 186.3333 |
| | 1.1.0511.30 | 32.0278 | 9.0000 | 288.2502 |
| | 1.1.0511.50 | 36.8333 | 18.0000 | 662.9994 |
| | 1.1.0512.20 | 10.3778 | 9.0000 | 93.4002 |
| | 1.1.0512.30 | 23.4444 | 18.0000 | 421.9997 |
| | 1.1.0512.50 | 33.1481 | 9.0000 | 298.3329 |
| | 1.1.0703.20 | 18.7500 | 9.0000 | 168.7500 |
| | 1.1.0703.30 | 28.7037 | 27.0000 | 774.9999 |
| | 1.1.0703.50 | 48.0952 | 9.0000 | 432.8568 |
| | 1.1.0705.20 | 101.0000 | 18.0000 | 1,818.0000 |
| | 1.1.0705.30 | 101.0000 | 18.0000 | 1,818.0000 |
| | 1.1.0705.50 | 102.6667 | 9.0000 | 924.0003 |
| | 1.1.0801.20 | 5.0909 | 18.0000 | 91.6362 |
| | 1.1.0801.30 | 5.5960 | 18.0000 | 100.7280 |
| | 1.1.0801.50 | 19.0185 | 9.0000 | 171.1665 |
| PRG.0703.UD | **TOTALS** | 38.2083 | 477.0000 | 18,225.3375 |
| PRG.0801.LD | 1.1.0101.20 | 8.9365 | 9.0000 | 80.4285 |
| | 1.1.0203.50 | 25.7670 | 9.0000 | 231.9030 |
| | 1.1.0301.30 | 21.5741 | 9.0000 | 194.1669 |

934160000045400:
199:775:JS:TG:2BA228
3M:875:JS:TG:Hirsch:2BA228

191 195

| PROGRAM | DISCIPLINE | DIR.COST/CR | CREDIT.HOURS | DIRECT.COST |
|---|---|---|---|---|
| | 1.1.0306.20 | 36.9511 | 9.0000 | 332.5599 |
| | 1.1.0420.20 | 62.2222 | 9.0000 | 559.9998 |
| | 1.1.0801.20 | 5.0909 | 45.0000 | 229.0905 |
| | 1.1.0801.30 | 5.5960 | 9.0000 | 50.3640 |
| PPG.0801.LD | **TOTALS** | 16.9547 | 99.0000 | 1,678.5126 |
| PPG.0801.MA | 1.1.0101.20 | 8.9365 | 9.0000 | 80.4285 |
| | 1.1.0101.30 | 15.8333 | 9.0000 | 142.4997 |
| | 1.1.0101.50 | 21.7779 | 9.0000 | 196.0002 |
| | 1.1.0203.20 | 13.2125 | 9.0000 | 118.9125 |
| | 1.1.0203.30 | 29.8919 | 9.0000 | 269.0271 |
| | 1.1.0203.50 | 25.7670 | 9.0000 | 231.9030 |
| | 1.1.0301.20 | 21.6667 | 18.0000 | 390.0006 |
| | 1.1.0301.30 | 21.5741 | 9.0000 | 194.1669 |
| | 1.1.0301.50 | 43.5185 | 9.0000 | 391.6665 |
| | 1.1.0306.20 | 36.9511 | 9.0000 | 332.5599 |
| | 1.1.0306.30 | 41.5806 | 9.0000 | 374.2254 |
| | 1.1.0306.50 | 71.9259 | 9.0000 | 647.3331 |
| | 1.1.0420.20 | 62.2222 | 9.0000 | 559.9998 |
| | 1.1.0420.30 | 158.5556 | 9.0000 | 1,427.0004 |
| | 1.1.0420.50 | 255.6296 | 9.0000 | 2,300.6664 |
| | 1.1.0422.20 | 11.0000 | 9.0000 | 99.0000 |
| | 1.1.0422.30 | 9.8889 | 9.0000 | 89.0001 |
| | 1.1.0422.50 | 13.4444 | 9.0000 | 120.9996 |
| | 1.1.0511.20 | 20.7037 | 9.0000 | 186.3333 |
| | 1.1.0511.30 | 32.0278 | 9.0000 | 288.2502 |
| | 1.1.0511.50 | 36.8333 | 9.0000 | 331.4997 |
| | 1.1.0512.20 | 10.3778 | 18.0000 | 186.8004 |
| | 1.1.0512.30 | 23.4444 | 9.0000 | 210.9996 |
| | 1.1.0512.50 | 33.1481 | 9.0000 | 298.3329 |
| | 1.1.0703.20 | 18.7500 | 9.0000 | 168.7500 |
| | 1.1.0703.30 | 28.7037 | 9.0000 | 258.3333 |
| | 1.1.0703.50 | 48.0952 | 9.0000 | 432.8568 |
| | 1.1.0705.20 | 101.0000 | 9.0000 | 909.0000 |
| | 1.1.0705.30 | 101.0000 | 9.0000 | 909.0000 |
| | 1.1.0705.50 | 102.6667 | 9.0000 | 924.0003 |
| | 1.1.0801.20 | 5.0909 | 9.0000 | 45.8181 |
| | 1.1.0801.30 | 5.5960 | 18.0000 | 100.7280 |
| | 1.1.0801.50 | 19.0185 | 27.0000 | 513.4995 |
| PPG.0801.MA | **TOTALS** | 40.1450 | 342.0000 | 13,729.5918 |
| PPG.0801.UD | 1.1.0703.20 | 18.7500 | 9.0000 | 168.7500 |
| | 1.1.0705.20 | 101.0000 | 9.0000 | 909.0000 |
| | 1.1.0801.20 | 5.0909 | 9.0000 | 45.8181 |
| | 1.1.0801.30 | 5.5960 | 45.0000 | 251.8200 |
| PPG.0801.UD | **TOTALS** | 19.1026 | 72.0000 | 1,375.3881 |
| FINAL TOTALS | | 35.3770 | 1,611.0000 | 56,992.3137 |

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